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- MOTHERBOARD BUYER'S GUIDE • COOLING ROUNDUP •
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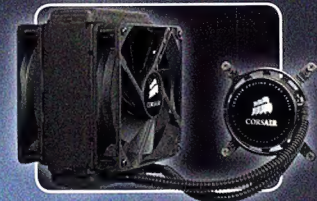
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ED HEAD

So many stories...

We allude to it in a couple of game reviews this month, but there are some games that are really, really hard to get a good handle on. Medal of Honor is one of them, with its two-engine take on the FPS, and vastly different gameplay mechanics between single and multiplayer.

But one other game this month was even more of a problem to tackle critically – Fallout: New Vegas.

We're huge fans of the Fallout franchise at Atomic, and New Vegas is quickly building its own Vault deep in our hearts. But in many ways it's a far less-polished game than its predecessor – however, most

gamers aren't really caring, which is kind of... odd. Any small issue in gameplay is usually passionately and loudly jumped on, but despite crashing, some poor scripting, and many graphics issues, most gamers are loudly proclaiming New Vegas as one of the best games this year.

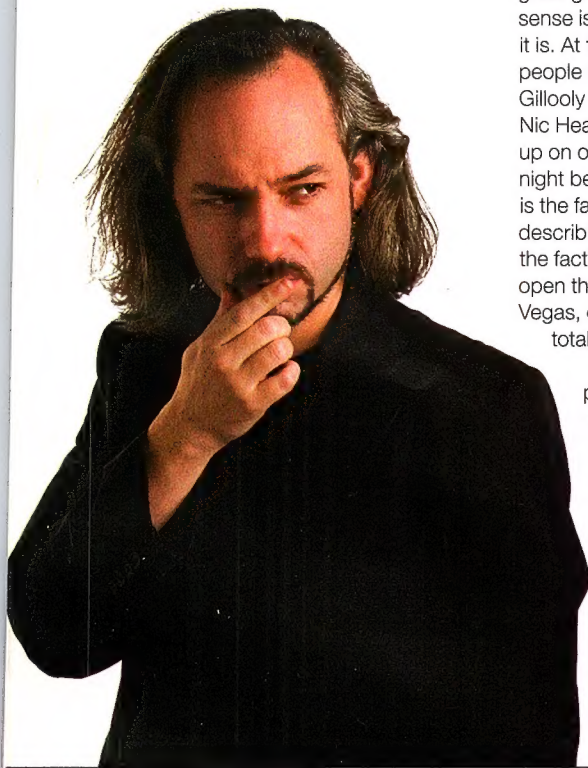
To be honest, we agree – it's a stunning achievement, and were it not for those bugs it would easily be giving some of our highest scoring titles, like Red Dead Redemption or Civ V, a serious run for their money. Without bugs, this is easily a game that deserves 100 per cent.

But the other thing that makes it both a great game and a hard game in a critical sense is how truly, wonderfully, open it is. At time of press, there are three people in the office playing it – John Gillooly and PC Authority's new Editor, Nic Healey – and every morning we catch up on our wastelands adventures of the night before. What's absolutely amazing is the fact that to an outsider, we could be describing different games – the choices, the factions, the world itself, are all just so open that while we're all in love with New Vegas, our experiences of the game are totally unique.

The common mantra about how prevalent bugs are today is fair, but Obsidian's just shown us what gamers really want. It's not a bug free game – it's an experience that shows you what gaming is all about.

And it's an experience which is really hard to review!

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Diablo III: Traits and Runes

There's a whole world of new customisation options coming in Diablo III - discover how you'll be building your next epic hero.

DIABLO

The Diablo buzz at BlizzCon hasn't all been PvP and the Demon Hunter class reveal - the developers also touted the new Trait system they'll be implementing to customise your character. We're still trying to come to grips with the mind-boggling number of customisations this system will offer players.

Traits: making your character more awesome

During the opening Diablo III panel Game Producer Jay Wilson took the time to point out a spear-wielding amazon sitting in the audience. This kind of weapon specialisation is just one aspect of character customisation that Blizzard wants to encourage in the game, not only for playing against the environment but also against other players in arena and other modes. Frenzy Barbarian? You got it! There are literally hundreds of thousands of other options.

Damien Love described the trait system as a way of changing a character's core abilities and modifying them for individual playstyle. There are approximately 30 traits for each core skill and most of them will have the option of spending up to five points into that trait, increasing that trait's effect. We should be seeing defensive traits that increase armour and other traits that increase damage - and everything in between. At this stage of development trait points are available every second level or so - but Wilson points out that this is subject to change and that at the moment the delivery-by-level of points doesn't feel quite right.

Talisman: Simply charming

During the panel developers talked about the use of charms in Diablo II and how players would gather as many charms as possible, keeping them in their inventory with barely room for a wee potion. Freeing

up inventory is a goal for Diablo III and in order for that to happen the next installment will include a charm management system called Talisman. This will be a separate inventory just for charms, sounding a little like the keychain implemented in World of Warcraft. The Talisman should grow as you need access to more space and you level.

Skill Runes: all glory to the giant toad

The runes themselves come in five flavours - Crimson, Indigo, Obsidian, Golden, Alabaster and should be loosely themed across the skills depending on what colour you choose. At this stage Runes have 7 ranks which apply more and more effect the more ranks you use. The panel showed us the effect of runes on the Wizard's Missile spell; starting off with only one missile for the Skill, by rank 7 of the Runed skill a veritable barrage of missiles mows down monsters - very satisfying. But perhaps not as satisfying as seeing the Witch Doctor's toads transformed into flaming toads, acid toads or, the ultimate, Giant Toad, which actually eats mobs. It also... er, processes the remains, leaving loot behind for you.

That's a lot of customisation options for any character - in fact Blizzard described it as an "@\$#load of options" and we tend to agree. Apparently the actual figure for custom build options using these new traits, skills and rune levels is 96,886,969,344. There's more than two commas in that, and it's also per class!

Farewell cookie-cutter builds. **LS**

BACKTALK

Wraith676 said: "Yeah, I really do believe this will be worth waiting for, the customisation options are insane. However, all the customisation in the world still won't stop cookie cutter builds. Unfortunately. Just makes it more interesting for people who don't cut cookies."

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FROM ATOMIC ONLINE

You know what I love? I love the 3rd season of Star Trek: The Next Generation - it has great writing, some wonderful performances from an ensemble cast starting to really come into their own, and some cracking stories.

Oh... and I also love awarding **POST OF THE MONTH** to a worthy Atomican!

As usual it's been quite the challenge sorting out who comes out on top this month, but in the end we've decided to pass on the POTM mantle to a certain stalwart of the Photography section, so the big ups go to...

Athiril! For continuing to deliver photographic awesomeness, and in particular helping another Atomican out in a purchasing thread right here:

<http://forums.atomicmpc.com.au/index.php?showtopic=36862>

Well done - Athiril walks away with this month's prize, a sexy Emperor Mouse from Razer. But of course, there's more awesome than that. Also on-song this month are:

nukejockey, and his excellent HAF build log.

<http://forums.atomicmpc.com.au/index.php?showtopic=36698&st>

Kommando, for his work of braaaaaainy excellence.

<http://forums.atomicmpc.com.au/index.php?showtopic=36919>

And, last but not least, Emperor_Matej_I for delivering some great legal learning.

<http://forums.atomicmpc.com.au/index.php?showtopic=36956&st=60&p=743459&#entry743459>

Well done all. Please join me in a resounding round of applause!



MODIFICATION

with Ashton "Mars is amazing" Mills

Nehrim: At Fate's Edge

Game Oblivion

URL www.nehrim.de

Nehrim. Its name is whispered in hushed voices among the forums of Oblivion. Its utterance is often accompanied by expressions of awe, and perhaps the over-emphatic zealous cries from a gaggle of excitable school-girls: raving-mad RPG-obsessed all-too-excitable cheese-loving school-girls, that is.

The reason is simple: Nehrim is not so much a mod for Oblivion, but a total conversion. Beyond the engine and a large chunk of models and textures, Nehrim is entirely separate from Oblivion. It even has its own landmass. It also features its own lore, quest lines, story, leveling mechanics, skill system and voice acting all its own.

Indeed the main story line is some 40 hours of gameplay long, depending how many side-quests you do. That's double what most commercial release games offer these days. Nehrim is so big, in fact, that it even has mods made for it.

The landmass is approximately the same size as Oblivion, but unlike Oblivion every last inch is hand-crafted. To say it looks beautiful is as much as understatement as to say the sun's



surface is just a tad warm. Combine this with an intriguing plot and apparently (as I haven't finished it yet) some of the best story-telling in the business, and you can quickly see why it didn't take long for this epic German mod to get an English translation. Unfortunately there's no equivalent voice acting, but when you consider the authors originally employed 56 voice actors and a professional studio to help out – not an easy thing to replicate – that's probably understandable. If you speak German, you'll love it.

Unlike Oblivion, in Nehrim your skills increase only as you level, much like traditional RPGs, but you also get 'learning points' for special skills and upgrades. Factions are still present, such as the Mages Guild, but you can't join them – they're more in the background, and usually occupied, for when you begin the game Nehrim is embroiled in war.

While you start as a novice monk from a remote abbey invited to a mysterious meeting,

pretty early on you get to make a choice about what direction your character should take: join the army and fight; join the secretive order who summoned you, and also threatened to kill you if you don't, or pursue your roots, which may reveal far more about your purpose than you realise. All of them hold potential, and it's great that the way onwards isn't so cut-and-dry as it was with Oblivion.

There are of course new enemies, equipment, special loot that has to be earned and nice touches like Mark and Teleport spells (ala Morrowind). There's simply too much new content to list, and this explains why the download is a hefty 1.6GB. Don't forget to grab the latest patch too.

Nehrim was four years in the making, and it shows. It's a beautifully crafted total conversion, taking you to another world that shares little in common with Oblivion; making it a brand new game in its own right. If you have love for Oblivion, grab Nehrim.



Sim Mars

Game Sim City 4

URL www.moddb.com/mods/simmars



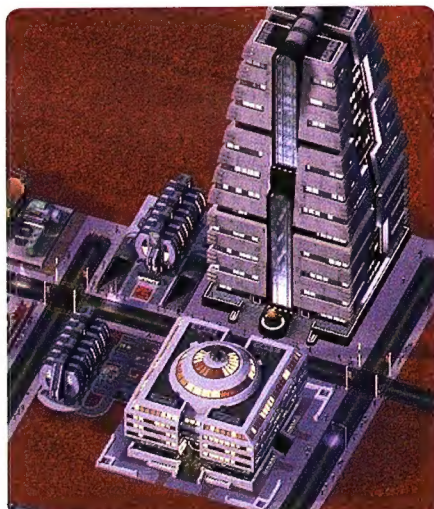
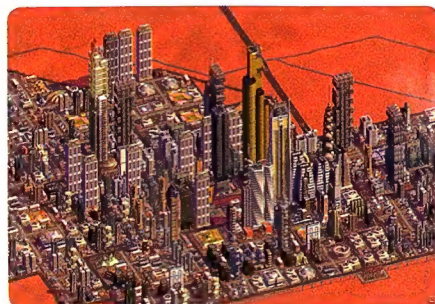
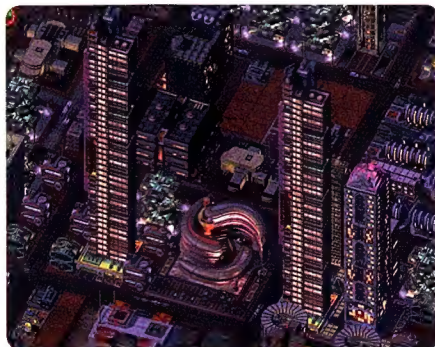
All you Simnatics out there rejoice, for now not only can you go building your dream city and toy with it like a cat with a city-sized ball of string, but you can do so *on Mars*. Blue water planet cities are so passe, bring in the red of rusted desert!

Three years in the making, Sim Mars brings the popular game to the red planet, changing almost every aspect to match the other-worldly realm: there are over 180 new buildings that have subtle touches like windows that reflect the red sand rather than the blue sky water of earth along with new low-gravity transport systems like the mag-lev, new space-dangerous disasters like the blow-out of decompression, and new Mars-themed news items. Naturally, there's also a new Mars-

themed interface to match the red planet, and new music tracks to get into a space-colony-building mood.

And, to make playing the mod easier, it comes with its very own launcher to start it independently of Sim City 4.

While only at Beta 3 it's already quite playable, and isn't a big download at 280MB. If you're a build-it-and-burn-it fan, dust off your copy and take a spin on the red planet. Who knows, maybe you'll find Opportunity too? (C)



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PATCH notes

X3: Terran Conflict Patch v1.0.1 to v3.0

Atlantica Online Patch v30207 to v303080

Starcraft 2 Patch v1.1.2

World of Warcraft Patch v3.3.0 to v4.0.1

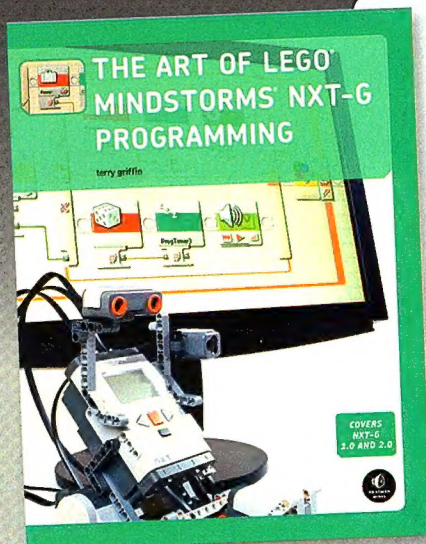
Ship Simulator Extremes Patch v1.2.2

Forgotten Hope Mod Patch v2.26
to v2.3 for Battlefield 2



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The Art of LEGO MINDSTORMS NXT-G Programming

Price: \$29.95 Website: www.nostarch.com

Last month, we got you started on your LEGO Technic robot. This month, we're taking things one giant leap further. Yes, that's right. MINDSTORMS. Robots. Real robots. Fully programmable, real-life robots. Yes, really.

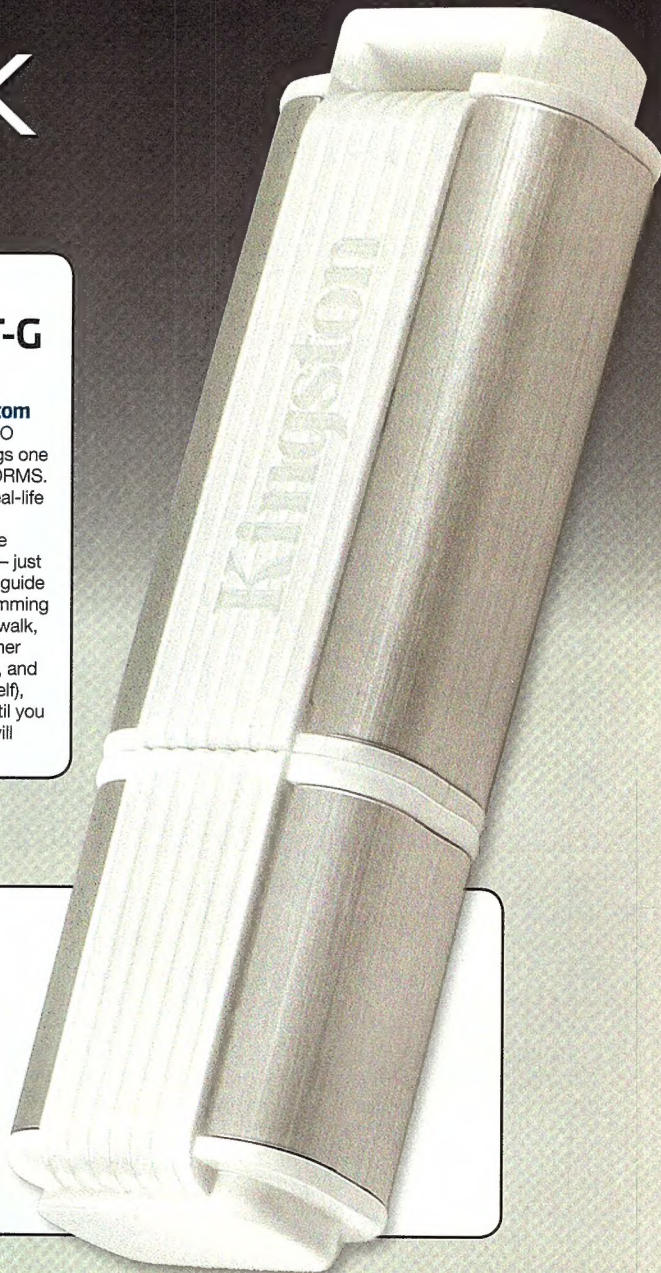
Thing is, we're not going to help you create them – you're Atomicans, you'll figure it out – just bring them to life already! This book is your guide to the LEGO MINDSTORMS NXT-G programming language – and if you want to get your robot to walk, talk, and respond to your requests for another beer (correctly: by getting you another beer, and not by telling you to get up and get it yourself), it's going to become your bible. At least until you teach your robot how to read, and then it will become *his* bible ...

Kingston Data Traveler Ultimate 3.0

Price: From \$119 (64GB) Website: www.kingston.com/anz

Just so you know, Kingston would never, ever endorse video piracy. When they tell us that you can write a movie to their fancy little USB 3.0 flash drive in 1 minutes 13 seconds, or a full DVD's worth of content in 1 minute 23 seconds, they're not actually suggesting we do it, any more than we would ever suggest you should do it, unless, of course, the movie and/or DVD content was obtained legally and you are legally permitted to copy it and put it onto a USB drive. Just so we're clear. We're looking at you, Uncle Torrence.

And really: those are some damn impressive write times. But then, this is a pretty impressive little flash drive. It's USB 3.0, for a start, but even if your computer is not, it'll still play nice (albeit by way of the enclosed y-cable for extra power). It can also hold up to 64GB of data – or about 15 DVDs worth, if you want to run with their example. Not that we, or they, would be encouraging you to do so, of course.



Western Digital My Passport My Passport Essential Limited Edition

Price: \$129.99 Website: www.westerndigital.com

One of the things that Designer_Dave hates about gearbox is just how dull everything is. Even if it's the most amazingly useful gadget in the world, it's probably black, and very likely box-shaped, and as a fan of colour and flair, this gets him a little down.

This is why WD's new limited edition range of My Passport Essential hard drives has got him all excited. Not only can he jam 500GB of his most important bits and pieces onto them, but they're colourful! And slightly curvy! And every bit as portable as the little black MyPassport he has sitting on his desk! Sure, the patterns are all kind of clichéd, on a base of either black, white or grey, but at least WD are making an effort to break out of the usual mould.





Samsung 3D Blu-Ray PVR BD-C8900A

Price: \$899 **Website:** www.samsung.com.au

With so much new entertainment technology flying around, it's not surprising that hardware guys aren't really sure what direction to take their products in at the moment.

Is 3D on the verge of take-off, or just another passing fad? Is Blu-ray finally going to knock DVD from its lofty perch of disc dominance? Will the PVR ever find favour in the Australian market? And where does the interwebs fit into all of this?

No-one really knows, and with the release of the BD-C8900A, Samsung seem to be freely admitting that this is not the time to put all of one's eggs in the same basket. This nifty little box is taking a punt at being all things to all people, and in these uncertain times, it might just be the way to approach the problem. A wee bit pricey for the privileged, but.



Silicon Power SDHC Class10 Memory Card

Price: TBC **Website:** www.silicon-power.com

Memory cards may not be the most fascinating bits of tech, but, like USB drives, they are just so damn useful. You don't necessarily need many of them, but you need them to hold lots of stuff and work fast enough for your purposes, and on these fronts, the Silicon Power SDHC does not disappoint.

It will hold tens of thousands of happy snaps, or a pretty awesome 12 hours of video, and has write speeds impressive enough for use with continuous stills shooting or HD video without any stutter or irritating 'please wait' screens.

As always, with something this small that holds this much stuff, and costs this much money, we'd like to remind you not to misplace it, especially once it's full, and especially before you've backed it up. In other words: don't be a loser, okay?

Logitech Harmony 650

Price: \$149.99 **Website:** www.logitech.com

Oh, the universal remote. How we love to lose you down the back of the couch, leaving us absolutely powerless over every single piece of technology we own, and usually at the most inappropriate moment.

The Logitech Harmony 650 is basically a new little brother for the Harmony 700 – the very product which brought universal remoting within the reach of the common man and his slightly common budget. It will control up to five devices – from your antiquated-but-loveable betamax box to your brand new 3D blu-ray player – and can be set up with 'one-click activity buttons', which will make it so simple to use that even your grandparents will be wanting one. Just try to stop them pointing at the Victrola.

A dark, high-contrast promotional poster for Call of Duty: Black Ops. The background features a soldier in tactical gear, with a rifle slung over their shoulder. The soldier's face is partially obscured by shadows. In the foreground, two hands are visible, each holding a handgun. The left hand's gun has "S&W" and "#1115" engraved on the slide. The right hand's gun is partially visible. The overall tone is gritty and action-oriented.

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The National Broadband Network

Does the NBN promise a bright telecommunications future? Jake Carroll investigates.

The Internet has changed the way we live. Statements like that conjure up some annoying telecommunications company throwing montage after montage at your television screen about 'empowering tomorrow' or 'inspiring the next generation'. All the glitz and smarm aside, it is the truth. The lives we lead are different, better and worse, because of the Internet.

Breathe deep and repeat after us. This X-Ray isn't about politics. This is about the NBN. We aren't going to get into whether or not there is technical or economic justification for the project, nor will we be discussing feasibility studies. It is what it is. Please leave your political persuasions in the box at the door.

How things are now

For the majority of Australians, we receive fixed-line services in the form of ADSL through the plain old telephone service (POTS) network. A smaller proportion of us can utilise an Internet connection using a hybrid fibre coaxial (HFC) transport provided by Telstra or Optus. There are additionally some specialised services such as LRE (Long Range Ethernet) and VHDSL/SDSL and bonded DSL that attract significant price premiums for businesses/users requiring more bandwidth.

For the rest of us who can't use these services, there are other technologies such as cellular network IP services, Satellite-based on the IPStar and SB Platforms, and wireless mesh infrastructure. For a privileged few, in some

relatively new communities, fibre to the premises services (FTTP) is being rolled out.

Meet the NBN

At some point in time, somebody in an office somewhere important suggested that bandwidth and connectivity were important things for the future of Australia in the economic and global prosperity sense. Whether you, the reader,

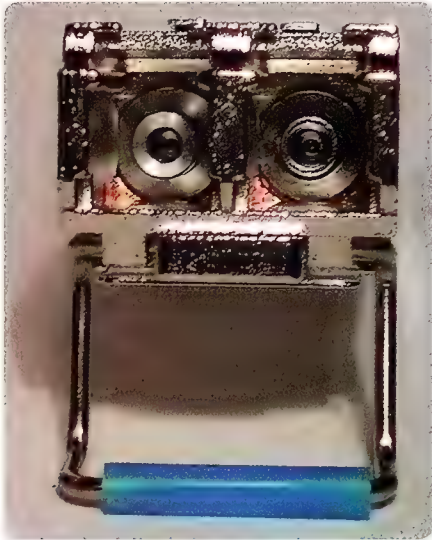
believe that or not, is academic. So strongly did the individual(s) feel that they went about campaigning to build this very large piece of infrastructure. The rest is history.

What is the NBN?

The NBN is billed as Australia's first national wholesale-only open-access high-speed broadband platform. To figure out what this



An ONT allowing the FTTP to actually 'make sense', in terms of switching and connectivity, of the traditional Ethernet/IP stack inside your house.



An SFP, capable of turning light to electrical signals in the form of 0s and 1s at speeds between a humble 1Gbit/sec, all the way through to 10Gbit/sec – on a single wavelength.

actually means, break those terms apart carefully:

- **Wholesale only:** It's a service saleable by a central body to other bodies that will on-sell the service with their own branding.
- **Open access:** There are no protocol or vendor specific eccentricities that deem it a closed environment, or one that uses a proprietary standard preventing other standards from interacting with the service.
- **High speed:** A service that we could consider fast by today's standards – with a quoted 100Mbit/sec standard connectivity option as a base service, and a 1Gbit/sec capability advertised. Speed is a subjective term.

If we look at the NBN website (<http://nbnco.com.au/>) for any significant information, we find it devoid of gritty technological detail. For reasons we don't fully appreciate or understand, the company sees fit not to publish exact details of infrastructure choices or implementation specifications. In fairness, this could be for many significant and sensible reasons, including commercial confidence concerns, and security policy. As early as the 7th of April, 2009, we were made aware that the NBN solution would use FTTP technology for 90 per cent of the population. On the 29th of May in the same year, the government called for mandatory FTTP for new housing estates created after the 1st of July 2010. In all of this however, the technical detail of the implementation has been obscured and run over. It was not until the 24th of June, 2010, when a vendor and primary provider of technology was named publically, in the form of Alcatel-Lucent.

How do we connect to this shiny miracle tube?

And so it was that a grand plan was hatched

to connect the country to super fast fibre at 100Mbit/sec (and beyond). In July 2010, three sites in Tasmania acted as the ultimate guinea pigs for the NBN. These sites were Midway Point, Scottsdale and Smithton. It should be noted, that as of this date, the NBN Tasmania group are a separate entity from the parent company NBN Co, operating independently, as NBN Tasmania were effectively the incubation and 'alpha-testing' mechanism that lead to the NBN Co, proper.

The media did a poor job of communicating how these lucky pioneer customers were connecting, unfortunately. The magical wonder device that makes optical fibre turn into useful connectivity is known as an Optical Network Terminal (ONT).

In a nutshell, the NBN uses fibre optic cables that run directly to the premises of a customer, which then in turn connects into the ONT unit, which then connects over plain old Cat6 cabling. Fibre optics and a grander understanding of the significance of the medium however isn't such a simple undertaking.

Bandwidth:

Fibre as a transmission medium has a near limitless bandwidth potential. As it stands, on the same piece of optical fibre, depending upon the transceivers, (the parts that produce and receive the light) we have seen speeds of transmission go from 1Gbit/sec to 2Gbit/sec within the space of a year, then 4.25Gbit/sec and 8Gbit/sec. The standard has now branched out to 10Gbit/sec and beyond, allowing up to 40Gbit/sec in a single small form factor pluggable device (SFP).

100Gbit/sec is coming, in the same form factor.

An attractive aspect of using fibre as a transmission medium is the ability to multiplex, sending multiple streams and channels of data at once, that can pass through the optics at any one point in time. Using techniques such as Dense Wave Division Multiplexing (DWDM) we can shoot different wavelengths (and effectively colours) of light down the one fibre cable, achieving greater than 1.6Tbit/sec in a medium that could previously only sustain 10Gbit/sec without the use of multiplexing.

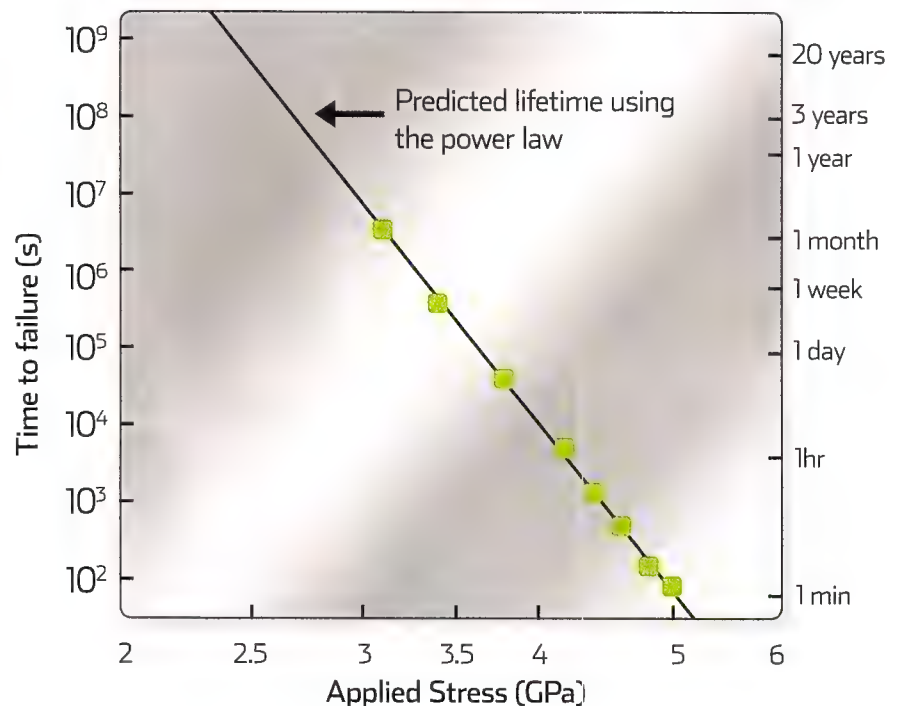
Single mode and multi mode:

Fibre optic cables come in two forms. From what we can gather thus far, a combination of Single Mode Optic Fibre (SMOF) and Multi Mode Optic Fibre (MMOF) will be used, with SMOF being dedicated to backhaul and large bearers, and MMOF being put to work for fly-leads and lead-in to homes.

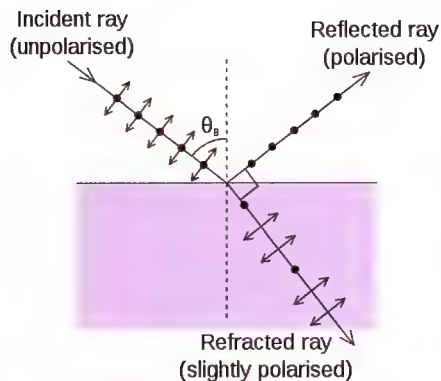
Single Mode cable carries a single 'ray' of light. A ray is generally referred to as a mode. SMOF has the characteristics of being able to carry light over long distances because it has a low modal dispersion rate. For this reason, backhaul links will generally be constructed of SMOF cables, running between large RSPs (Retail Service Providers) and points of presence.

Multi Mode Fibre is the most common used in generic communications. A 10Gbit/sec throughput rate can be attained as far as 600 meters using an MMOF cable and SFP's. The cable has a larger 'light gathering' capability than SMOF, and typically uses much cheaper SFP technologies relying on light emitting

Static fatigue and lifetime prediction of an optical fiber



Lifespan prediction of optic fibre based upon stress applied to a sample.



Brewster's angle calculation.

diodes, rather than lasers (which are used by SMOF SFPs) to produce the ray for transmission. Shorter distances are the trade-off, but are perfect for consumer grade applications, such as the lead in/fly leads to your house from a central Ethernet aggregation switch, as per the tentative NBN model.

Degradation characteristics

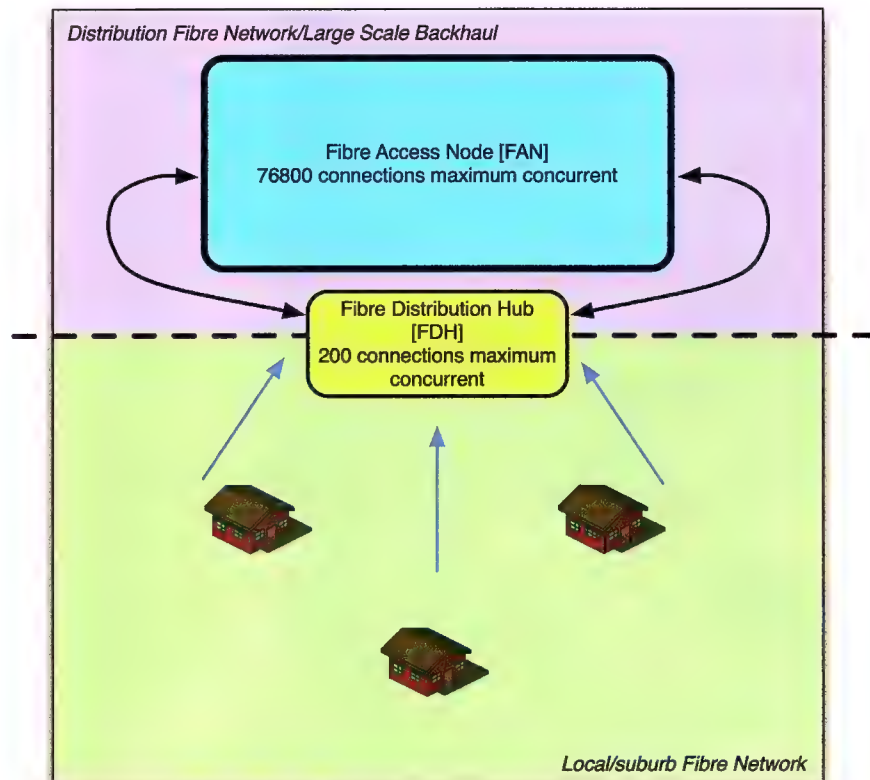
As to the reliability and longevity of optic fibre cable – much has been made of its durability in the mainstream media. Several IEEE papers we've sourced suggest a 25- to 40-year life span, depending upon the application and conditions. A further study, conducted in 2003 at Rutgers University and entitled 'Mechanical reliability of silica in optic fiber' (Shiue et al), suggested through experimentation that time to failure was a function of applied stress (GPa). The results concluded that a lifespan of 20 years could be yielded with a 2.5GPa pressure point.

To put that into real world perspective, however... that is 2.5 million tonnes per square metre of pressure. Given it's hard to anticipate this kind of pressure being exerted on a cable in conduit in your front yard, the life span of the cable could be much greater.

Knowing a little more about the cabling itself now, it's time to get to the crux of it.

Getting your GPON on

We've arrived at the GPON station. A Gigabit Passive Optical Network is a specific type of FTTP architecture. It uses unpowered optical splitters that use a physical principle known as Brewster's angle to enable a single optic fibre to



Large-scale network to local network hierarchy.

serve multiple sites.

The push behind using GPON for the NBN was driven by ease of deployment and sensible cabling infrastructure. GPON allows a group of fibre connections at the RSP end to travel unmodified across large-scale backhaul, with a clear path to Fibre Access Nodes, of which there would be potentially one in a suburb. This would then break down further to Fibre Distribution Hubs, with a maximum of 200 individual building connections per Hub, then finally to optical network terminals (ONTs) at each dwelling.

Passive and active networks: how and why

Passive optical networks don't use electrically powered devices to split the signals, as we've mentioned above. Beam splitters utilising Brewster's angle generally split signals from

a single fibre strand into 16, 32 or 64 unique strands. These splitting points don't provide us with any switching or buffering capabilities, and as such rely on other parts of the network to do this. Each signal that leaves an RSP and travels down a backhaul cable must be broadcast to all users served by the local splitter (including those users' premises that didn't request that signal, and wasn't intended for them!), hence there is a great deal of reliance placed on the ONT to filter out what was meant for the end recipient and what was meant for others on the same splitter, as well as carrying out WDM tasks.

The advantages of passive networks are that they avoid complexity in keeping sensitive electronics operating in outdoor or uncontrollable conditions and can actually support analogue broadcast signals. The disadvantage in the use of a passive network however is that because each customer has an ONT that must transmit all the way back to the RSP (rather than to the nearest active-type switch device), the premises and associated customers can't be as far away from the central dispatch for backhaul as they could if they'd utilised active optical networks.

Product mode and delivery methods

The final part in the NBN story (for the time being, as this really is an unfinished tale, mark our words) involves the actual technology and protocol used for delivery. To be clear, we aren't talking about TCP/IP here. That's at a layer inside your house, and back at the RSP. The



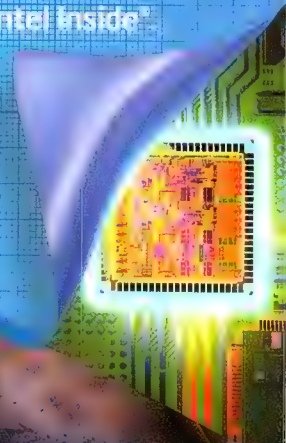
A photograph taken of a window with a polarising filter rotated to two different angles. In the picture at left, the polariser is aligned with the window reflection. In the picture at right, the polariser has been rotated 90°, eliminating the heavily polarised reflected sunlight. This the principle of how a passive splitter functions.



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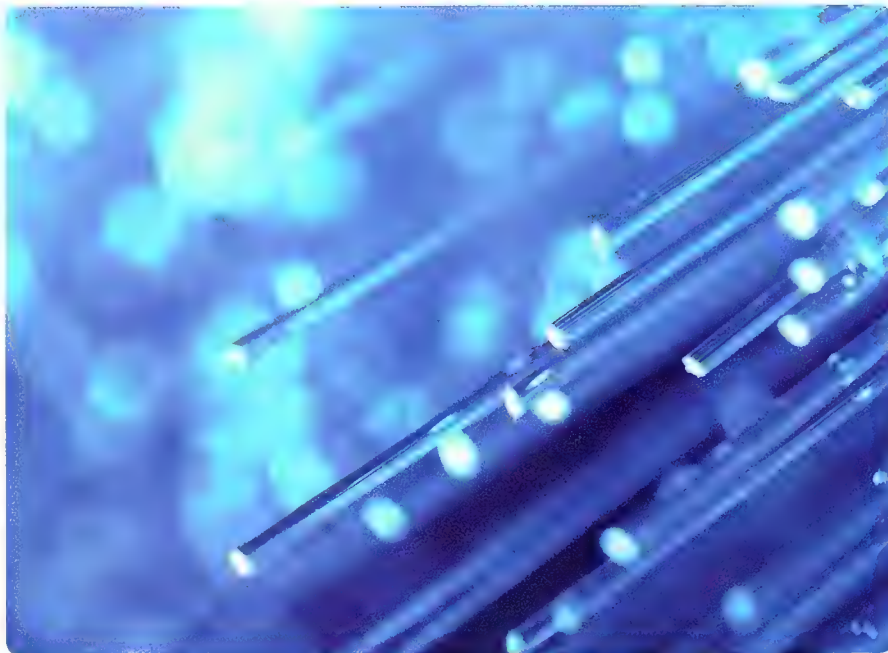
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two products that NBNCo are offering as their wholesale delivery platform are known as:

- Local Ethernet Bitstream (LEB)
- Aggregated Ethernet Bitstream (AEB)

LEB will typically be provided in metro and city suburbs. It consists of a per end user element that provides a connection between the ONT unit, and the FAN with given service parameters.

AEBs will typically be provided in rural or lower density/country areas. Unlike the LEB, AEBs consist of three components. First, as with the LEB, a per-enduser element for ONT to FAN connectivity. Next, a fibre transit circuit that links the AEB 'Access Link' to the AEB 'Connectivity Link'. This element will be called the AEB 'Transit

Link'. Finally, an interface element connecting AEB transit links to the wholesale customers. It's effectively two different ways of gathering up cables and getting the data from the end user, back to the point where it can travel to the RSP.

Lessons from elsewhere

What NBNCo sets out to do is going to change the country in some way. What it isn't, is an original concept. This has been thought of before, with a similar scale, similar budgets and just as ambitious horizons. India's NKN or National Knowledge Network is also well underway, with similar goals and aspirations for coverage, latency and bandwidth capabilities

(their benchmark is 2.5Gbit/sec to major sites). The difference in India is that the infrastructure project had no vocal opposition or political argument. It just happened, as the official suggested. India's CCI or Cabinet Committee for Infrastructure approved the project on March 26th 2010 for deployment.

With some luck, we'll see further evolution of the NBN very shortly, with stage two and three sites being announced in quick succession. Many things seem to be in a state of flux, with many aspects of the services provided not being standardised, nor agreed upon. With Telstra and Optus both capable of providing DOCSIS 3.0 services at 100Mbit/sec to HFC enabled end users right now, the NBN's relevance will be tested and measured in time to market, value for money and overall performance.

With the majority of end users having ownership of a router/switch combination who's front end host processor probably isn't capable of offloading 100Mbit/sec on a WAN port (if you think a WRT54G will even survive 38Mbit, think again!), real world throughput might need some expectations management.

With the most current documentation from NBNCo focusing on the points of interconnection (<http://tinyurl.com/2dupbw8>) and the merits of putting these POIs in different regions – to benefit performance, improve the economics and flexibility of the network – the impression we can draw from the paper is that we're still very much in infancy of development. The company is effectively still asking the tenders, suppliers and RSPs for their thoughts, rather than suggesting a definite way forward.

The shrill cries of telco-battles are expected soon; but for the time being it is political stumbling blocks, competition in several different forms, and old-fashioned bureaucracy that capture more minds than the infrastructure itself. ☹



A Linksys (Cisco) WRT-610N, with a 480MHz Broadcom SoC processor. It will have enough front end processor capability to deal with 100Mbit/sec connectivity on a WAN port. For a gigabit however, the market is ill-prepared. With all cynicism aside, brace yourselves for thousands of "My NBN is slow, I want my money back!" style posts.



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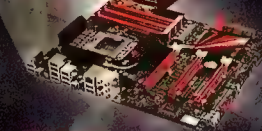
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Mana from modding

Ashton Mills waxes lyrical about his favourite pastime...

I'm kind of known as the mod guy for Atomic because it's something I've been doing for a while. I started with map making for DOOM, creating single and multiplayer deathmatch maps. I also had a habit – and still do – of trying new things and seeing how far the engine could go: like using floor lifts shaped like doors to open on approach via trigger points; or building a maze with invisible walls so you could see the bad guys, but not realise you couldn't shoot them until it was too late (yeah, I was like a bastard dungeon master, only in mapper form).

And the best part of this, like all modding of course, is finishing something and having other gamers appreciate your work. But modding, like

the way to careers for some gamers. One of the biggest mods for Oblivion – Oscuros Oblivion Overhaul – eventually saw its creator, Jorge Salgado, offered a position with Obsidian, whose latest title you're probably playing right now: Fallout New Vegas. And artist Matt Regan and mapper Andrew Weldon who provided content for Natural Selection, though itself a mod for Half Life, are now onboard with Unknown Worlds working on Natural Selection 2, which will be a paid standalone product. More recently modders Daniel Tracy and Morgan Kita, who are building MechWarrior: Living Legends – which isn't even complete yet – so impressed Crytek that the company hired the pair. They're

if you're good, make a lot of something else out of it too – in the first two weeks of sale, a team of five modders earned some \$US45,000 for their creations. And that's with Valve taking 75 per cent of the asking price, as well.

It's a brilliant move, despite the hefty slice Valve takes (though owning both the game and the delivery platform does allow them to call the shots), and hopefully something that other publishers take up.

Regardless of whether modding is a creative outlet, or a way to showcase your abilities, it's a good thing to have under your belt if you want to get into the games industry. It's like a foot in the door. And if it's just a hobby, you might soon be able to turn a buck for it too if Valve's model takes off, which can only be a good thing. 

And the best part of this, like all modding of course, is finishing something and having other gamers appreciate your work.

game development itself, is becoming an ever more time-consuming process. Some of the world's classic original games, like DOOM, were developed on a shoe string. Now nothing less than millions of dollars will get big-name titles out the door (as a sidenote, small development houses producing less blockbuster titles are called 'indie' these days, when once this was actually the norm).

Similarly, modding for large games can take an enormous amount of effort. Map building for titles like Crysis or Fallout takes into account far more features and variables than in the past (you need to worry about 3D planes, physics, trigger points, linked cells, lighting, and more), modules and animation are infinitely more complex, and we can even play with AI and script entirely new functions (which is mostly what I do these days).

It's awesome, of course, but would be even better if you could get paid to do it too. So what if you could?

Modding has, in some circumstances, paved

still learning to speak the language in Germany, but they love it.

Of course, sometimes you can just write game proof of concepts, too. Portal began as a project called Nerbacular Drop, before Valve saw the potential and snapped up the development team. Because ultimately, your work is your resume.

Gaining employment is one thing, but can you make moolah while freelance modding too?

Valve recently started an interesting new project, the MANN Co. store, for Team Fortress 2 that allows players to not only purchase Valve made items, but community-made items too. Compared to the flexibility of modding on some titles the scope of creation is quite limited – these are pre-defined objects mostly requiring models and textures, and there are some (fairly) strict rules that need to be followed by potential modders (such as maintaining the same visual theme), but none the less you can make something and put it up on the store. And

Ashton's mods are certainly worth paying for...

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INPUTOUTPUT

Dan Rutter brings the answers to your questions like no-one else can.

I/O OF THE MONTH

Laaaaaag!

I I've just moved from using my PS3 on an Asus MW221U 22in monitor (PS3@720P, HDMI-DVI Adapter,) to a Sony KDL40HX800 40in LCD (PS3@1080P, HDMI). On connecting up the shiny new panel something is just not the same, mostly when playing MW2. I think what I am trying to overcome is input lag on the Sony.

Following a few of the standard tricks like enabling 'game mode', and connecting the PS3 to the panel directly rather than through the AV receiver, there was a noticeable difference, but playing between both panels you still get a feeling you are behind the events on screen.

I have done an input lag test by running the 22in and 40in as clones from my PC from each output of a 4870, DVI direct to the 22in and with a DVI to HDMI adapter to the 40in. Based on the timers, there is 40-60ms delay to the Sony when running in its default game mode and up to 100ms on other settings.

With such a range of TVs out there and a lot of people using them for HD gaming, is big-screen choice contributing to the potential of some gamers and the frustration of others? Trying to get information prior to purchase is a nightmare, with most people confusing it with pixel response time. Apart from trying the VGA input on the TV from the PS3 (not sure how that'd work out), and maybe exploring the service menu, is there something else I can do to reduce the time it takes to get the picture on the screen?

Andrew Ryan

O Quick answer: No. There are a few things I could suggest, but you've done them all already!

The actual input lag of a modern HDTV with 'game mode' turned on is, usually, too small to notice. The problem is that there's also an inescapable baseline lag for any 3D software – on a console, or a PC.

The graphics card can't 'rasterise' an image for display until it's rendered it, and it can't render it until the CPU has figured out what needs rendering, and there's a little more delay on top of that because the CPU can't deal with new input if it's still busy with previous input. If a given hardware-and-game combination quantises logic, rendering and rasterising all at the same 50Hz speed starting at the vertical-blank moment, then it's impossible for any input to produce output less than three frames later. That gives a baseline of 3/50ths of a second of lag, or 60 milliseconds.

(Things get trickier when simulation, rendering and output threads are running at different speeds. Many modern games poll input very fast, and have fast simulation threads, but never output more than 30 distinct frames per second. It's also possible to hand data to the GPU before a whole frame worth of it has been calculated, and monkey with vblank timing. And then there are games that *look* laggy because the rendering thread lags behind the simulation one; you see your gun fire 50ms after the simulation registered the event. And the list goes on.)

60ms of lag is only noticeable if you're a pretty twitchy gamer playing a pretty twitchy game, but 60ms plus *another* 60ms of output-device lag will always be noticeable.

It is indeed difficult, if not impossible, to get HDTV manufacturers to cough up input-lag numbers. This is partly because the numbers vary depending on what the HDTV is displaying, but mainly because lag numbers aren't actually improving with each generation.

I/O OTM



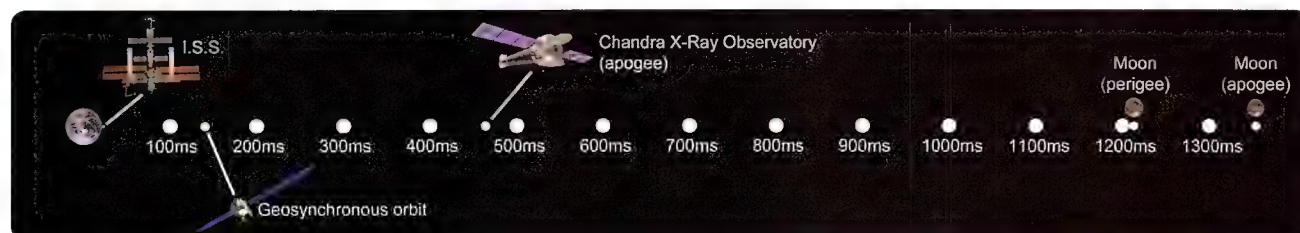
WINS A THERMALTAKE CHALLENGER PRO KEYBOARD

Once you've got the HDTV in your house you can measure lag by, as you did, setting up side-by-side screens (an old CRT TV or monitor has zero inherent lag), or by pointing a video camera at the HDTV and your controller and counting frames between button-press and on-screen action.

The video-camera method lets you figure out whether changing settings really makes a difference, but if it tells you your HDTV is lagtacular no matter what you do, your only options are to put up with it, or return it.

If you haven't *bought* your HDTV yet, you can calculate lag by taking your PC or console to the shop, which will conveniently probably also have a video camera you can use. The chance of this being doable in any randomly-chosen shop is low, but a bit of phoning around will probably find you somewhere with agreeable gamers on staff.

It's also possible to short-cut the whole palaver if someone's already tested a TV you're considering, and posted the results online. A few years ago the Web-forum pickings in this department were thin, but as HDTVs get cheaper and cheaper, and more and more people learn about the problem (if only by wondering why Guitar Hero and Rock Band have those calibration options now).



I'm sure we've all wondered how far your monitor would have to be from your couch for light-speed to create perceptible lag. (200,000-kilometre cables would more than double the numbers!)

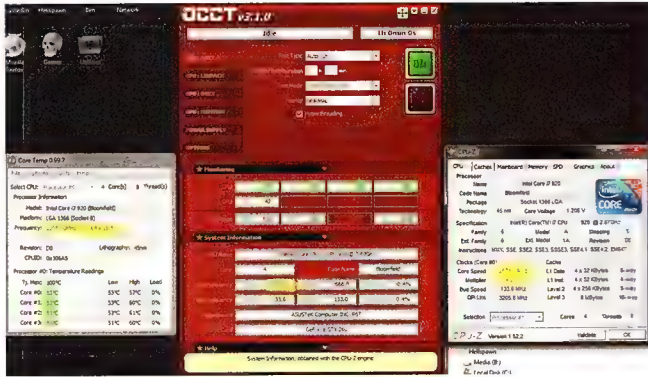
Measure with micrometer, mark with chalk, cut with axe

I How is it possible for several system monitoring programs to report different sets of CPU clocks and temperatures?

I've disabled SpeedStep in the BIOS but Core Temp still says that the BIOS is under-clocking my CPU – why is this?

I have an i7 920, P6T mobo, and standard cooler.

Ben Stringfield



O A temperature sensor – actually, the hardware-monitoring chip to which the analogue sensors are connected – does not actually report a temperature. It reports a *number*, which different programs (including the BIOS setup program) interpret in different ways.

So even if a given program reckons it recognises whatever hardware-monitoring chip your motherboard (and/or graphics card) uses, it may give wildly wrong numbers if your mobo/CPU/probably-BIOS-version-too combination has changed the relationship between the reported number and the actual temperature.

You can also get *subtly* wrong numbers if your temperature sensors read a bit high or low. This latter problem – more common at lower temperatures than higher, I think – is seldom worth worrying about. Just remember that if one computer seems to be consistently running three degrees warmer than another, there may actually not be any difference at all. An idle-temperature difference may be entirely illusory, even if it's reported as being quite large.

It's sort of like car speedometers, which don't actually directly monitor speed – they monitor how rapidly the wheels are rotating. Put smaller wheels on your car and your speedo will read high, put bigger wheels on and it'll read low. (And rollin' on 20s will probably soon be interrupted by red and blue lights.)

The multiplier works the same way. There's no single standard way for a CPU and motherboard to tell a monitoring program the CPU bus speed, multiplier and/or core speed, so once again the monitoring software has to explicitly recognise the hardware it's running on.

I think Real Temp gets the numbers right for most current systems, including Core i7s: <http://www.techpowerup.com/realtemp/>

The docs page also talks about how to calibrate the software to get really accurate numbers: <http://www.techpowerup.com/realtemp/docs.php>

Plugging electron-leaks

I I remember how happy I was with my first set of NiMH AA batteries. My digital camera worked for more than a few lousy shots. I soon discovered their limitation, in the form of self-discharge, so I couldn't have them charged and sitting on my shelf waiting for use when I needed them. Around 2008 I came across Duracell 'Active-Charge' low-self-discharge NiMH and bought a set, thinking I'd give them a try and buy another set if they went well after 6-12 months. Surprise surprise, they worked very well, but when I went back to buy more, none of the batteries carried the Active-Charge branding.

Do these type of batteries still exist (from Duracell or other common battery manufacturers available in retail outlets)? Are they just the standard NiMH available everywhere today and not carrying the extra branding?

A. Stacey

O If the package doesn't specifically say 'pre-charged' or 'ready-to-use' or something of that sort (you probably won't see 'low self-discharge' actually written on the pack), the batteries will be the standard high-self-discharge type. I can identify no clear relationship between battery brand and discharge rate; as a general rule, NiMH cells with higher capacity will have higher self-discharge, but that's not a guaranteed relationship, and most if not all battery brands inflate the capacity numbers anyway.

Standard NiMH cells are fine for high-discharge, short-standby applications like remote control toys and powering frequently-used photo flashes. They're acceptable for cordless phones and even cordless PC input devices, too, if you're able to put them on charge when you're not using them.

For applications with significant standby time, though, more expensive LSD cells with lower nominal capacity will work much better.

There are rather more brands of LSD NiMH cell than there are actual different kinds of cell under the shrinkwrap. The current 'Duracell Pre-Charged' LSDs, for instance, are actually Sanyo cells – just different packaging for the same cells sold under Sanyo's Eneloop brand:

<http://bit.ly/durasanyo>

I think they still are Sanyos under the skin.

You can save a few bucks if you buy LSD cells from eBay dealers. Lesser-known brands like Uniross's Hybrio or Gold Peak's ReCyko cost a bit less, but work the same.

The price difference isn't large any more, though, so unless you're really pinching pennies or buying a lot of batteries, you might as well get them locally. ☺



Ultimate guide to MOTHER

James Corbold shows you the best features to look for in your next upgrading hunt.

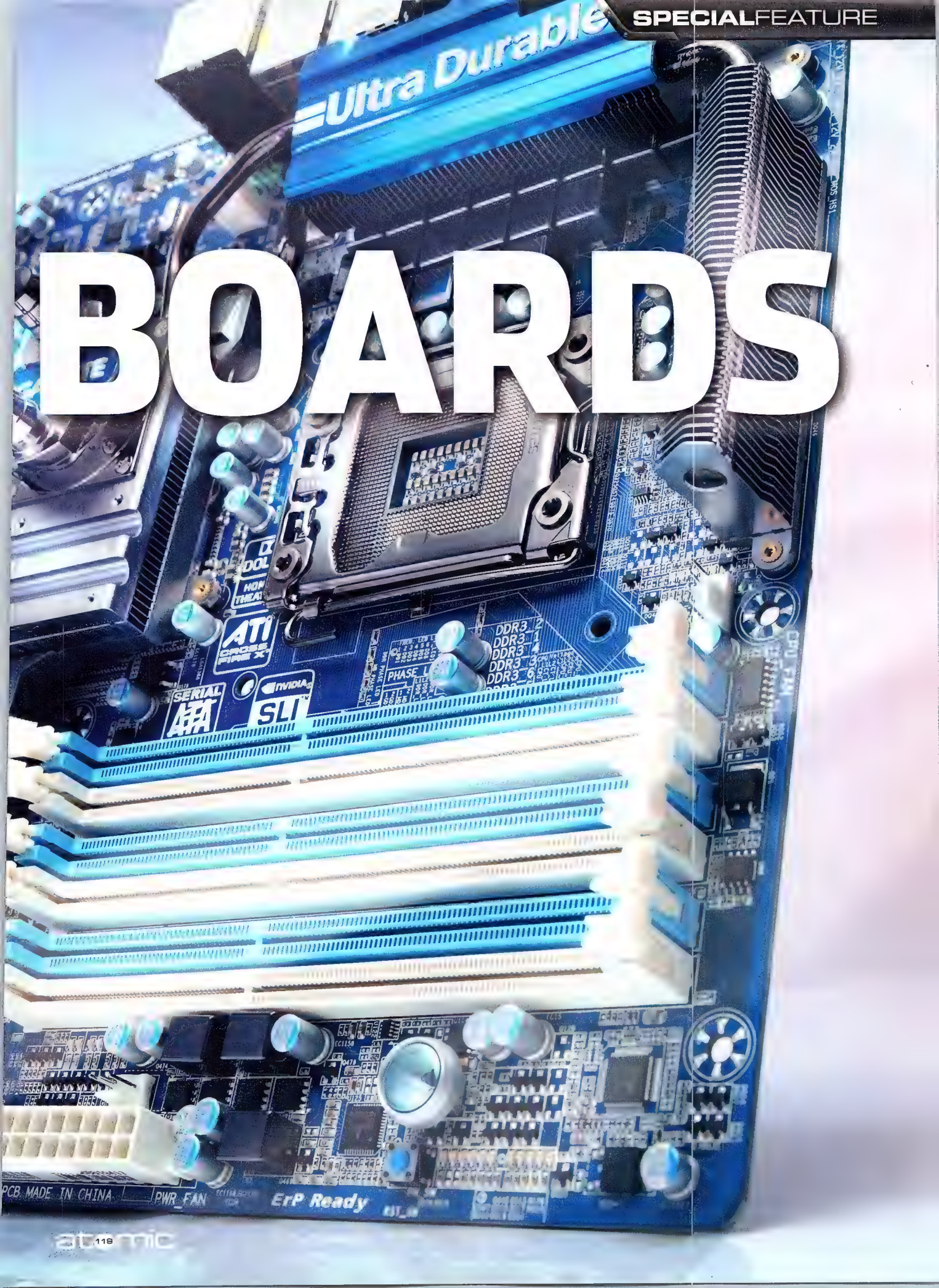
After a decade of intense competition, the PC industry is finally seeing a new wave of innovation. With the introduction of the AMD Phenom II and Intel Core i7 processors, the market is seeing a new wave of performance and efficiency. The new processors are designed to handle the most demanding workloads, from gaming to business applications. The new processors are also designed to be more energy efficient, which is a big win for the environment. The new processors are also designed to be more reliable, which is a big win for the business user. The new processors are also designed to be more secure, which is a big win for the enterprise user. The new processors are also designed to be more compatible, which is a big win for the consumer user. The new processors are also designed to be more affordable, which is a big win for the budget user. The new processors are also designed to be more powerful, which is a big win for the enthusiast user. The new processors are also designed to be more efficient, which is a big win for the eco-conscious user. The new processors are also designed to be more reliable, which is a big win for the business user. The new processors are also designed to be more secure, which is a big win for the enterprise user. The new processors are also designed to be more compatible, which is a big win for the consumer user. The new processors are also designed to be more affordable, which is a big win for the budget user. The new processors are also designed to be more powerful, which is a big win for the enthusiast user. The new processors are also designed to be more efficient, which is a big win for the eco-conscious user.

When you're looking for a new motherboard, there are a few things you should look for. First, you should look for a motherboard that supports the processor you want to use. Second, you should look for a motherboard that has the features you need, such as SATA ports, USB ports, and audio ports. Third, you should look for a motherboard that is reliable and secure. Fourth, you should look for a motherboard that is compatible with your other hardware. Finally, you should look for a motherboard that is affordable.



Ultra Durable

BOARDS



PCB MADE IN CHINA

PWR_FAN

ErP Ready

Anatomy of a Motherboard

REAR I/O

This is the only part of the motherboard visible from outside the case, and it's where you connect all your external peripherals, such as keyboard, mouse and speakers to your PC via the I/O (input/output) ports. Most motherboards also sport a number of additional ports, see 'Front I/O' below.

EXPANSION SLOTS

While most motherboards include basic on-board audio and drive controllers, if you want anything fancy, such as a dedicated sound card, you'll need a motherboard with the appropriate free expansion slots. Apart from a few esoteric types in servers or custom machines, most expansion slots adhere to one of three common standards.

These are two generations of PCI-E slots and the older PCI standard. First-generation and PCI-E 2.0 slots are physically identical and are therefore compatible with one another, but PCI-E 2.0 slots provide twice as much bandwidth, which is a crucial factor for graphics cards.

Both generations of PCI-E are available in four sizes – 1x, 4x, 8x and 16x, with the number referring to the slot's number of lanes. The more lanes a slot has, or connections to the motherboard, the greater the bandwidth. Graphics cards generally require 8x or 16x slots, but less demanding cards, such as sound cards and TV tuners, typically only have a 1x connector.

CHIPSET

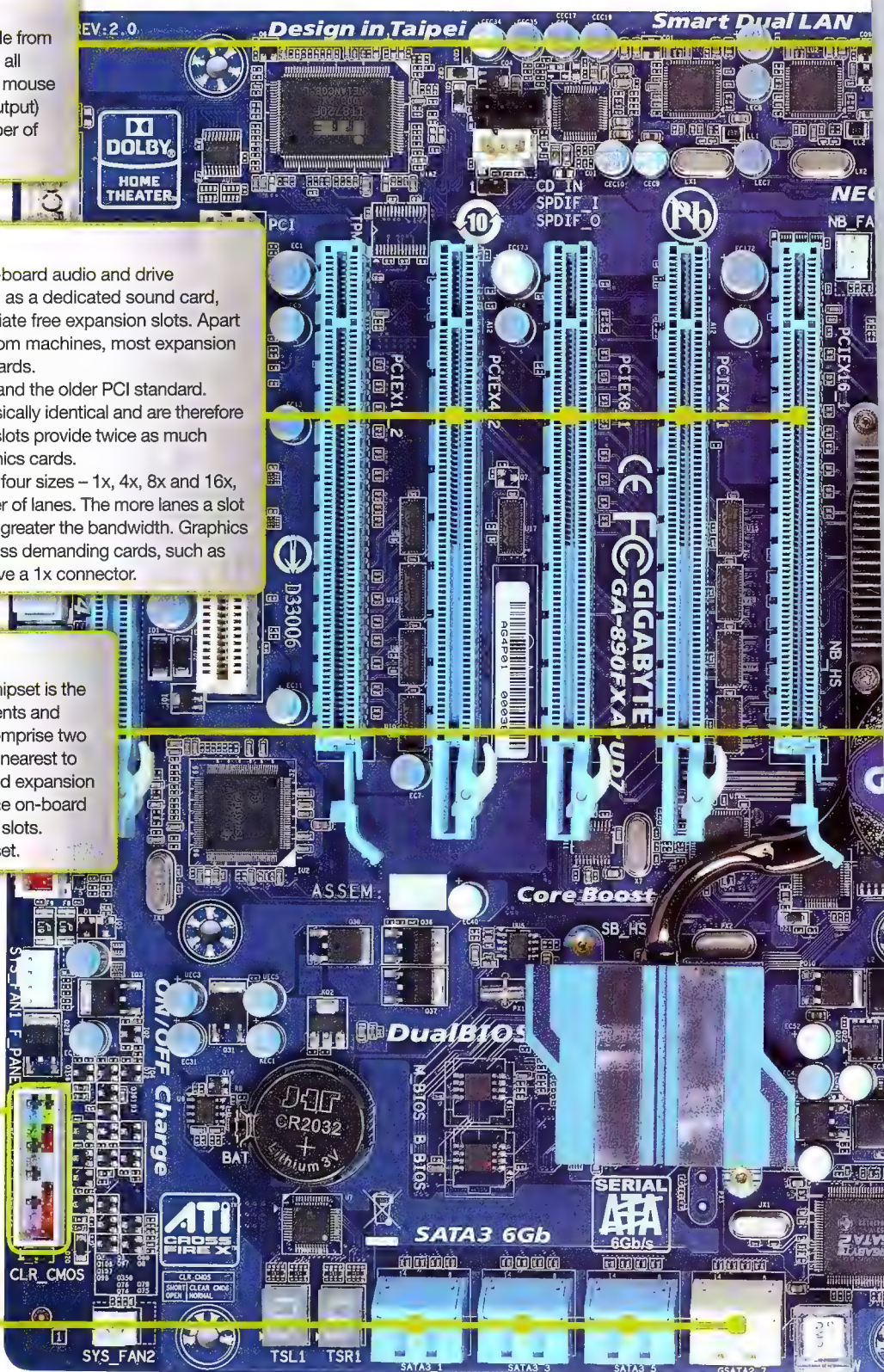
If the CPU is the brain of your PC then the chipset is the nervous system, connecting all the components and allowing them to share data. AMD boards comprise two separate chipsets: the Northbridge, which is nearest to the CPU socket and controls the memory and expansion slots; and the Southbridge, which controls the on-board audio, drive controllers and some expansion slots. Mainstream Intel boards have only one chipset.

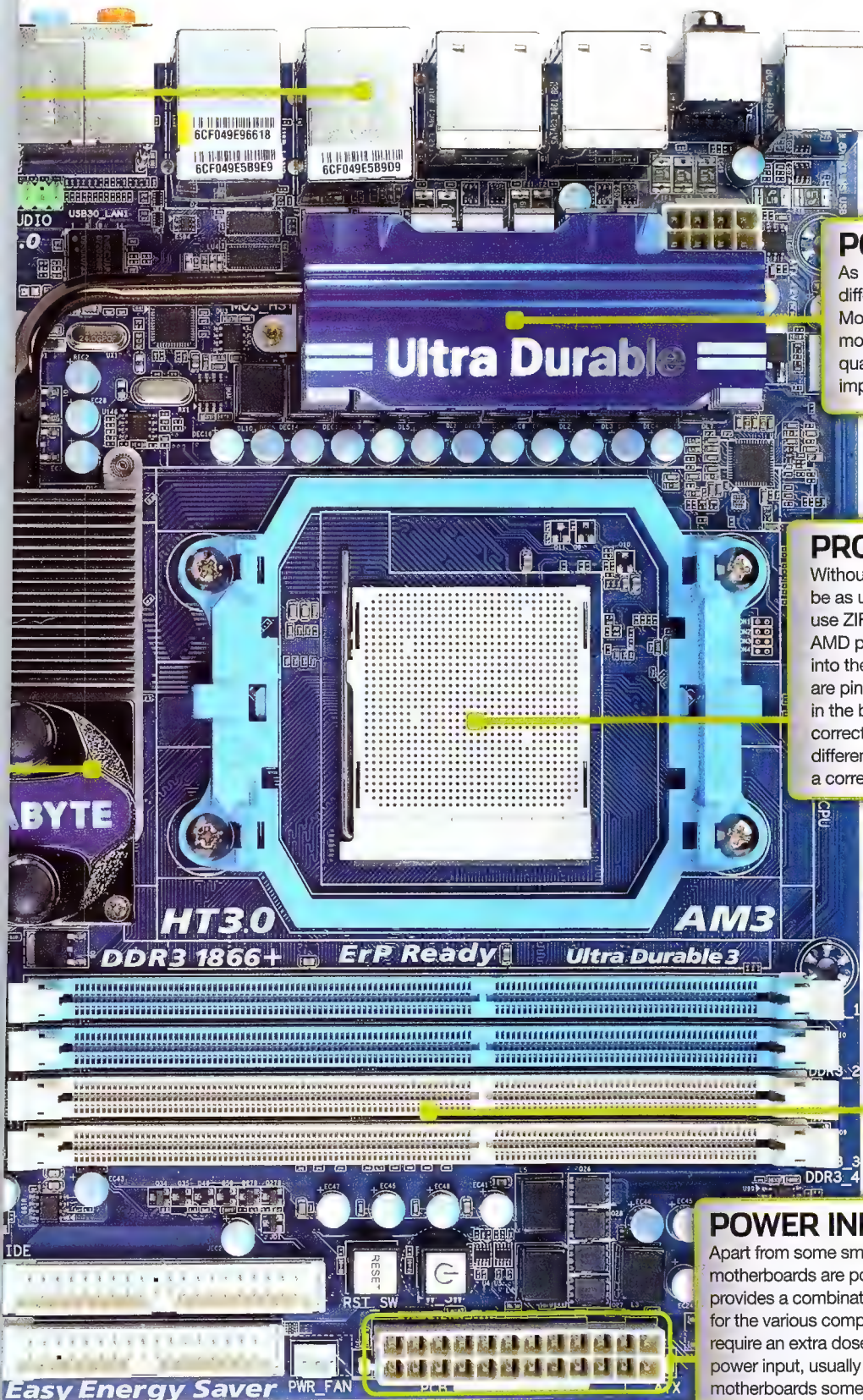
FRONT I/O

These headers are where you plug in the cables from the USB, power and reset switches on the front of your case. Always be careful to insert the case cables the right way around – the positive lead is always coloured, while the negative is white or black.

DRIVE CONNECTORS

Unless you have a fancy discrete RAID controller, this is where you'll plug in your hard disks, SSDs and optical drives. Modern drives use the SATA bus, but some budget motherboards still include the bulky 34-pin FDD and 40-pin IDE connectors for older drives.





POWER DELIVERY

As each of the circuits on the motherboard run at different voltages, the VRMs (Voltage Regulator Modules) adjust the 12V power supplied to the motherboard to the appropriate level. Good-quality VRMs that are adequately cooled are imperative if you plan on overclocking your CPU.

PROCESSOR SOCKET

Without a processor installed, your motherboard will be as useful as a zombie surgeon. All modern CPUs use ZIF sockets (zero insertion force), and though AMD processors have pins on the bottom that plug into the socket on the motherboard, Intel CPUs are pinless, and instead sit on top of a bed of pins in the base of the socket. Make sure you buy the correct CPU for your motherboard, as there are many different types of processor socket – and each needs a corresponding chip.

MEMORY SLOTS

These DIMM slots (dual in-line memory module) are where you install your system memory. DIMM slots are usually colour-coded, indicating which slots to use to set the memory in dual- or triple-channel mode. AMD board channels usually use slots 1-2/3-4 for memory sticks, while Intel LGA1156 boards take the form of 1-3/2-4.

POWER INPUTS

Apart from some small form factor designs, most modern motherboards are powered by a large 24-pin ATX connector. This provides a combination of power voltages of 3.3V, 5V, 12V and -12V for the various components on the motherboard. Modern CPUs require an extra dose of power, so they have their own dedicated power input, usually an 8-pin EPS12V connector, although budget motherboards sometimes have the simpler 4-pin ATX12V connector.

How to choose a Motherboard

Deciding which motherboard to buy is a multi-step process, involving several interrelated decisions. Here's how to wrap your head around the components.

STEP 1: CPU SOCKET

The first questions you need to ask yourself are: what activities do you want to use your PC for, how fast it needs to be, and what your combined budget for the CPU and motherboard is. The answers to these questions will tell you which price range you should be looking at and which features you need, and therefore which processors your motherboard needs to support.

While we can't answer these questions for each individual reader, we've compiled four scenarios, based on what we currently think are the best combinations of CPU and motherboard at certain price points.

By now you should have a pretty good idea of which CPUs your new motherboard needs to support. However, as AMD and Intel's branding isn't particularly clear, we've compiled a table below, listing which sockets support which CPUs. As some retailers still list some previous-generation motherboards and CPUs on their websites, we've also included these in the table. Be aware, however, that while older components may be cheaper than current hardware, you'll find it harder to buy compatible peripherals such as coolers and RAM, and if you run into any problems, it's unlikely that you'll find much support.

Chipssets Table

CPU socket	Supported CPUs
LGA1156	Intel Pentium G6950, Core i3, Core i5, Core i7-800-series
LGA1366	Intel Core i7-900-series
LGA775 ¹	Intel Core 2 Duo/Quad/Extreme, Celeron 1000-series, Pentium
Socket AM2+ ¹	AMD Athlon II (920 and 940), Phenom, Athlon X2
Socket AM3	AMD Athlon II (not 920 or 940), Phenom II, Sempron 140

¹ = older, discontinued platform

How much do you have to spend on the CPU and motherboard?



DUAL-PROCESSOR MOTHERBOARDS

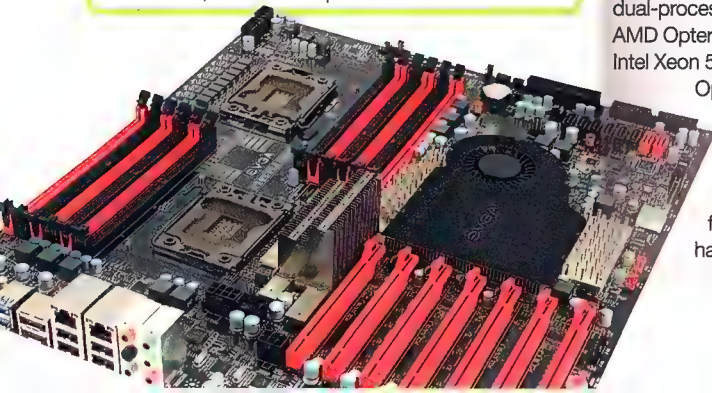
While most of the 'How to choose a motherboard' section of this feature focuses on single-processor motherboards, as that's what most PC enthusiasts buy, we also wanted to address the specific requirements of a dual-processor motherboard. It's worth considering dual-processor system for any highly parallel CPU intensive task such as 3D rendering/video editing/encoding, and simulations such as protein folding or raytracing.

Currently, there are two main types of dual-processor motherboard, those for the AMD Opteron 6000-series and those for Intel Xeon 5500/5600-series. The 12-core Opteron 6000-series CPUs use the G34 socket and are supported by two chipsets – the AMD SR5670 and SR5690. The former is intended for use in servers, while the latter has additional PCI-E 2.0 lanes (42

compared to 30) for use in workstations. The quad-core Intel Xeon 5500- and 6-core Xeon 5600-series also have two chipsets; the workstation-optimised Intel 5520 has 36 PCI-E 2.0 lanes while the server-optimised Intel 5500 has 24 PCI-E 2.0 lanes.

The most important factor to keep in mind when choosing a dual-processor motherboard is that most are extended ATX (E-ATX), as opposed to ATX, so you'll need the appropriate sized case. Most dual-processor motherboards also have two 8-pin EPS12V power sockets rather than one, so you'll need a suitably equipped PSU.

Dual-processor motherboards with more than one 16x PCI-E slot support CrossFire, but don't be fooled by the SLI logo that some of these sport – they don't support gaming SLI. Instead, the logo refers to SLI using Nvidia's range of workstation-optimised Quadro cards for CUDA.



STEP 2: FORM FACTOR

Once you know which processor socket your new motherboard will have, you choose your form factor. The right form factor is crucial, as it will determine how many expansion cards you can install, the maximum amount of system memory, and size of case you will be able to buy. After all, it makes no sense to build a media PC or office system using an E-ATX motherboard, as you'll have to buy a huge and costly case. Although there are dozens of different form factors available, there are only four standardised form factors of which you need be aware; these are, in ascending size order, mini-ITX, micro-ATX, ATX and E-ATX.

ATX

The vast majority of motherboards are ATX, which is a rectangular (305 x 244mm) form factor with sufficient space for up to seven expansion card slots and up to six memory slots. This is the most flexible type of form factor, as it provides sufficient space for all but the most specialised of PCs (workstations, servers and so on). We'd recommend that most gamers choose an ATX motherboard, as this will provide sufficient room for several graphics cards with space left over for a sound or wireless card. For a budget build or media PC, an ATX motherboard is overkill; instead, we recommend buying a micro-ATX board that saves on un-needed space.

MICRO-ATX

Micro-ATX is a scaled-down version of ATX; measuring just 244 x 244mm, it only has room for up to four expansion card slots. A micro-ATX motherboard will be adequate for a basic gaming rig with single-or-dual graphics cards or a sound card, but for anything more complex, it will be cramped. Even dual-slot graphics cards need three slots to operate optimally (two for the card, and one for the fan to breathe).

The micro-ATX form factor is most suitable for media and budget PCs thanks to its compact dimensions and low cost. There's simply no reason to buy anything bigger or expensive when you won't be installing lots of expansion slots.

As an added bonus, depending on the chipset used, many micro-ATX have on-board graphics, so you won't have to buy a discrete graphics card.

However, cheaper micro-ATX motherboards use lower-quality VRMs and BIOSes than ATX boards, so they have much less overclocking headroom. Finally, many micro-ATX motherboards have fewer DIMM slots than ATX

boards, limiting how much system memory can be installed.

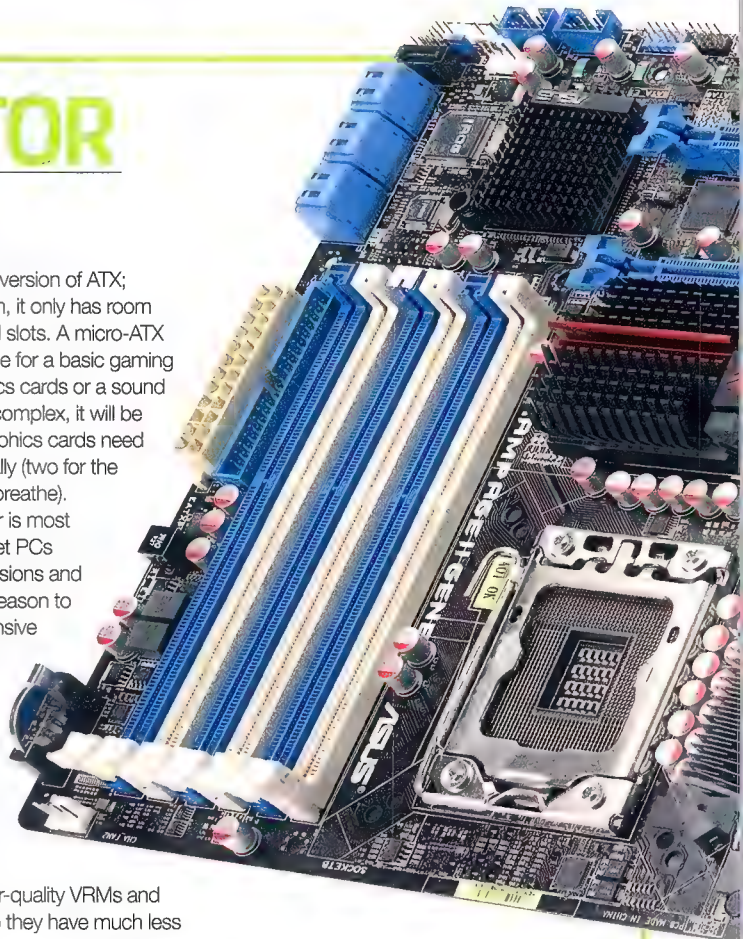
E-ATX

E-ATX is the stretch-limo version of ATX, and is 25mm wider. This means that 305 x 330mm E-ATX motherboards are limited to the same seven expansion card slots as ATX motherboards. However, because they're slightly wider, they provide more space for additional features such as more memory slots or a second CPU socket.

MINI-ITX

While all three variants of the ATX standard are backwards compatible with one another (an E-ATX case will support an ATX or micro-ATX motherboard), mini-ITX is an entirely separate standard. At just 170 x 170mm, mini-ITX is considerably smaller than micro-ATX and is designed for low-power industrial PCs. However, since its debut in 2001, the mini-ITX form factor has become increasingly popular with modders – it fits almost anywhere.

As mini-ITX motherboards only have a single expansion card slot, they nearly all include on-board graphics, plus basic networking and audio. Due to the lack of space for complex VRMs, mini-ATX boards are unable to support high-TDP CPUs and have very little overclocking headroom, but if you're building an ultra-compact system, then a mini-ITX motherboard is well worth considering.



ATX

Micro-ATX

Mini-ITX

E-ATX

STEP 3: CHIPSET

The final decision to make in the process of choosing which motherboard you buy is which chipset it uses. The chipset is essentially the nervous system of the motherboard, and therefore determines how many and which kind of features and expansion slots can be supported.

Traditionally, motherboards required two separate ICs – the Northbridge and Southbridge. The Northbridge was tasked with handling the system memory and communication between the CPU and graphics card(s) via the PCIe 16x expansion slots. The Southbridge was responsible for handling the slower PCI and PCIe 1x slots, drive controllers and I/O ports.

However, all new CPUs now include an integrated memory controller, so the Northbridge on most motherboards only has to handle the graphics cards. Only high-end Intel boards use a Northbridge, as some CPUs, such as the Intel LGA1156 chips, have an on-board PCI-e controller. Some Intel LGA1156 CPUs also have on-board graphics, so these processors require a motherboard and chipset that can handle their output. While AMD hasn't yet gone this far down the integration route, some of its chipsets include on-board graphics. These are a lot more capable than the on-board Intel graphics, but not powerful enough to play games at high detail settings smoothly.

The table below lists the various chipsets available for each CPU socket and their principal features when used together.

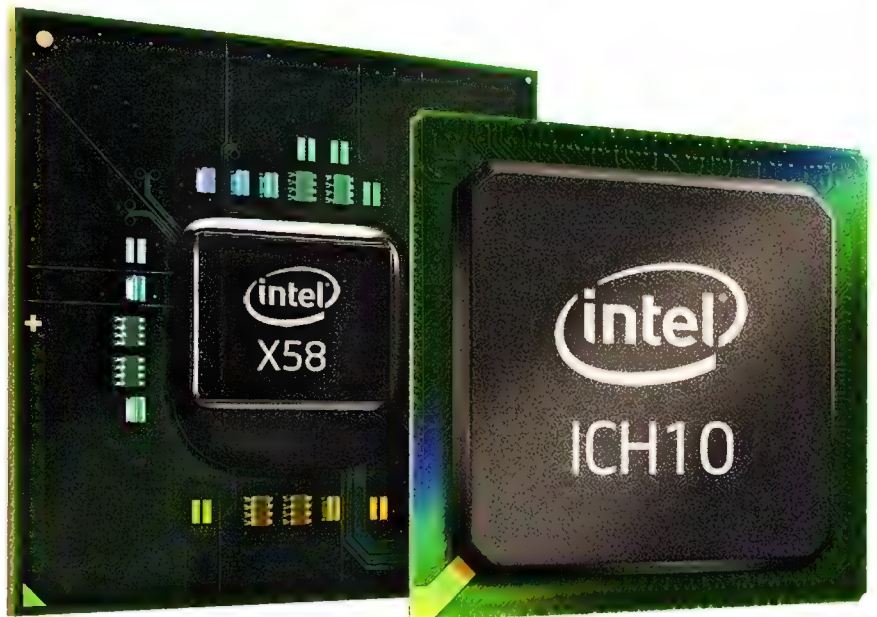
Thanks to some really confusing Intel branding, not all combinations of chipset and CPU work together as you might expect. For example, while a Core i7-800-

series CPU series will work in an Intel H55, H57, Q57 motherboard, the CPU doesn't have an on-board GPU: you won't be able to use the graphics outputs on these motherboards. Similarly, while a Core i3 or Core i5-600-series CPU (which have integrated graphics) will work in a Intel P55 motherboard, this chipset has no graphics outputs, and the integrated GPU will go unused. In these cases you'll have to buy a discrete graphics card.

In addition, it's important to note that it's at the discretion of motherboard manufacturers which features each of its boards will support. For example, manufacturers often produce cut-

down models with some of the chipsets listed in the table disabled. For example, the 16 PCI-e lanes of the Intel P55 chipset can theoretically be divided into two slots, each with eight lanes. However, you'll find that cheaper P55 motherboards, such as the Biostar TP55, have only one 16x slot, as this is cheaper to design and implement than two 8x slots.

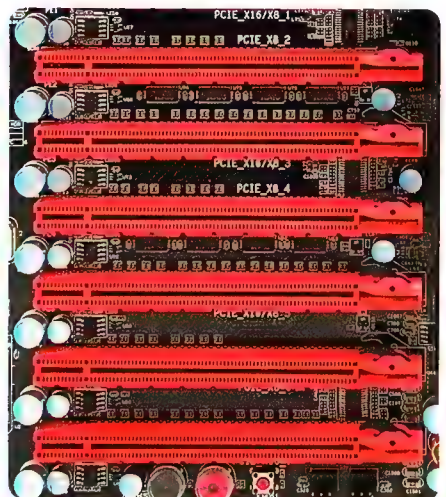
At the opposite end of the spectrum, some motherboards are fitted with supplementary controllers, so they have more features than the table suggests. For example, the high-end Intel X58 chipset predates SATA3 and USB 3.0, and therefore doesn't natively support either of these super-fast interfaces. However, with the addition



Chipset Comparison Table

CPU socket	Chipset	Notable features
LGA1156	Intel H55	Intel GMA HD on-board graphics ¹ , 16 x PCI-e 2.0 lanes ² , SATA2
	Intel H57	Intel GMA HD on-board graphics ¹ , 16 x PCI-e 2.0 lanes ^{2,3} , SATA2
	Intel Q57	Intel GMA HD on-board graphics ¹ , 16 x PCI-e 2.0 lanes ² , SATA2
	Intel P55	16 x PCI-e 2.0 lanes ^{2,3} , SATA2
LGA1366	Intel X58	36 x PCI-e 2.0 lanes ^{3,4} , SATA2
Socket AM3	AMD 890FX	32 x PCI-e 2.0 lanes + 4 x PCI-3 2.0 lanes ³ , SATA3
	AMD 890GX	ATI Radeon HD 4290 on-board graphics, 16 x PCI-3 2.0 lanes + 4 x PCI-E 2.0 lanes ³ , SATA3
	AMD 880G	ATI Radeon HD 4250 on-board graphics, 16 x PCI-e 2.0 lanes + 4 x PCI-E 2.0 lanes ³ , SATA3
	AMD 870	16 x PCI-e 2.0 lanes + 4 x PCI-E 2.0 lanes ³ , SATA3

1 = Display outputs only, 2 = Via PCI-e controller in CPU, 3 = Crossfire support, 4 = SLI support



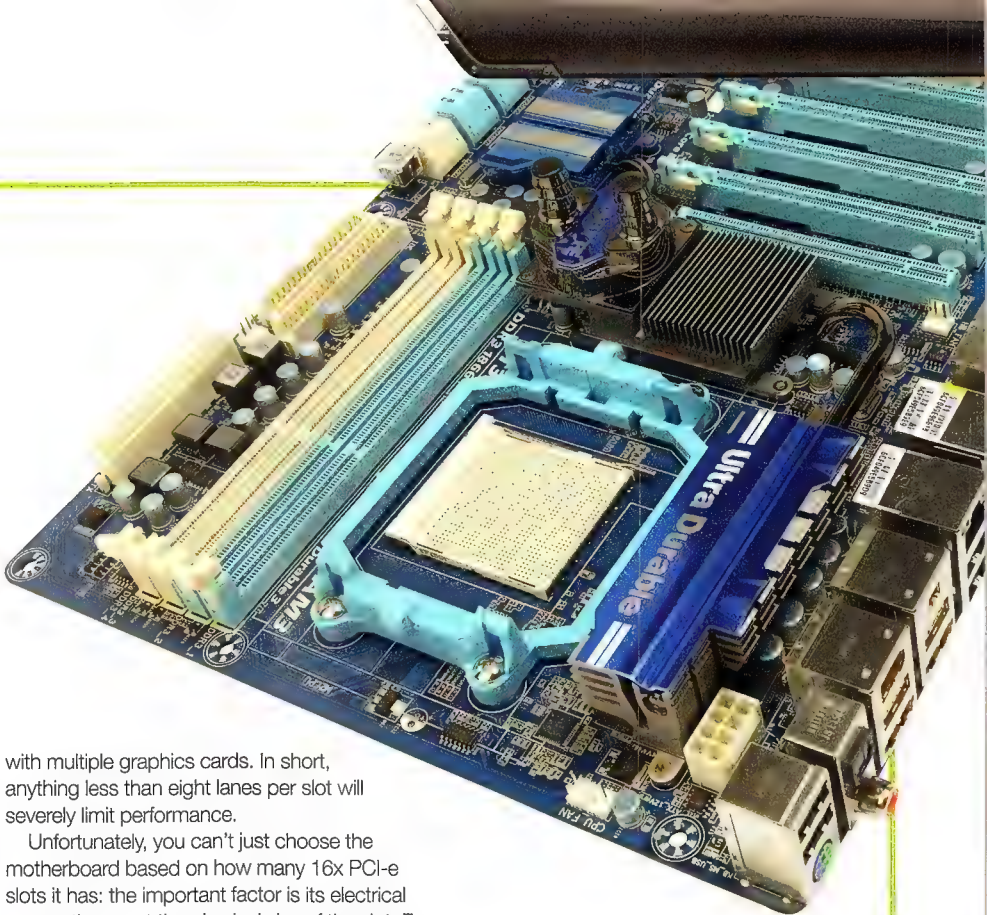
of some Marvell and NEC controllers, many recent X58 motherboards now support SATA 6Gbps and USB 3.

THE PCI-e RIDDLE

Gamers who want to install multiple graphics cards in their PC need to make sure that the motherboard chipset supports either CrossFire, if you're using ATI/AMD graphics cards, or SLI, if you're using NVIDIA cards. CrossFire can theoretically support up to four cards, while SLI only supports two. If you want to install three or more NVIDIA cards, you'll need to buy a motherboard that's multi-SLI certified.

While many of the chipsets listed on the table (across) support CrossFire, SLI certification is much more haphazard (motherboard manufacturers have to pay NVIDIA a licensing fee per board). Therefore, you need to check the fine print of a motherboard's data sheet very carefully to see if it supports SLI.

Even when you know that the motherboard in which you're interested supports CrossFire or SLI, this isn't sufficient to ensure optimum performance – how the PCI-e lanes are configured is massively important for a system



with multiple graphics cards. In short, anything less than eight lanes per slot will severely limit performance.

Unfortunately, you can't just choose the motherboard based on how many 16x PCI-e slots it has: the important factor is its electrical connections, not the physical size of the slot. For example, while most P55 motherboards have two 16x slots, you'll typically find that many such boards provide 16 lanes to one slot and four lanes to the other, and will therefore perform very poorly in multi-GPU setups. If you want to install two graphics cards in a P55 motherboard, you need to make sure that it provides each of its 16x PCI-e slots with eight lanes.

PCI-e lane allocation can also be a problem for high-end motherboards. A good example of this is the growing number of Intel X58 motherboards with seven PCI-e slots. At first glance, this doesn't seem to make sense, as the X58 chipset only supports 36 lanes, so each slot would be equipped with less than five lanes, crippling performance. ASUS, EVGA and GIGABYTE have worked around this problem

by adding supplementary PCI-e controllers to their motherboards. A good example of this is the EVGA SR2 from the Atomic beast; thanks to its two Nvidia nForce 200 PCI-e controllers, it provides six of its 16x PCI-e slots with eight lanes each and the one remaining 16x PCI-e slot with 16 lanes. While this arrangement is costly and consumes a lot of power, it ensures that each 16x PCI-e slot has sufficient bandwidth to perform adequately.

CHOOSING THE CHIPSET

With so many chipsets from which to choose, we've compiled this handy buying guide based on our four recommended CPUs in Stage 1.



Which CPU type did you choose in Stage 1?

LGA1156 Intel Pentium G6950

Our recommendation: Clarkdale-core CPUs such as the Pentium G6950 (or the more expensive Core i3-series) perform and overclock very well on the Intel H55/H57 and Q57 chipsets and also on the Intel P55 chipset. As the H57 and Q57 chipsets are aimed more at the business market, we recommend buying a motherboard based on the consumer-orientated H55 chipset. If you aren't intending to play games on your PC then you can use the on-board graphics that the combination of H55 chipset and CPU provides. Gamers should buy a discrete graphics card to ensure a smooth frame rate in games, as it is only just enough for video playback.

LGA1366 Intel Core i7-950/960/980X

Our recommendation: As there's only one chipset that supports LGA1366 CPUs, your only choice is a motherboard based on the Intel X58 chipset. Make sure that you buy a motherboard with a supplementary SATA3 and USB 3.0 controller so that you can make full use of the latest drives and peripherals.

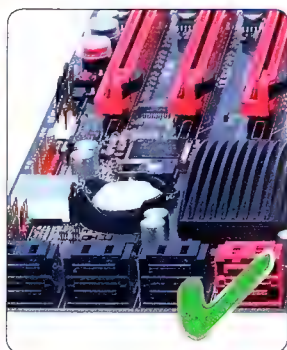
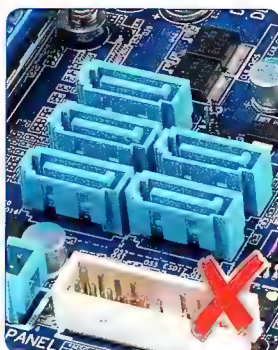
LGA1156 Intel Core i5-760

Our recommendation: As a gamer, there's no point in paying for the low-performance graphics outputs of the 32nm Intel chips. Therefore, we recommend buying a P55 motherboard with this speedy quad-core processor.

DESIGN PRINCIPLES

Now that you're armed with all the information required to choose the right motherboard for your next upgrade, we're going to look at some of the enthusiast features that help to make a great motherboard.

SATA PORTS



SATA ports were initially mounted so that they protruded vertically from the surface of the motherboard. However, this leads to cables standing in the middle of the motherboard, making them hard to conceal and reducing airflow through the case. In some cases it was so bad that some SATA ports became unusable if a dual-slot graphics card was used. Budget motherboards may still take this route, though the E-ATX design avoids it.

Look for: SATA ports mounted parallel with the PCB.

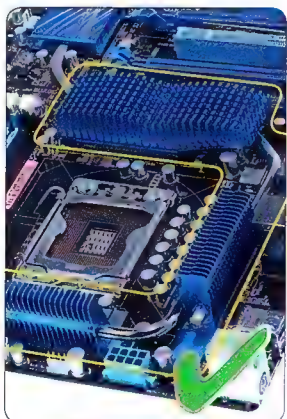
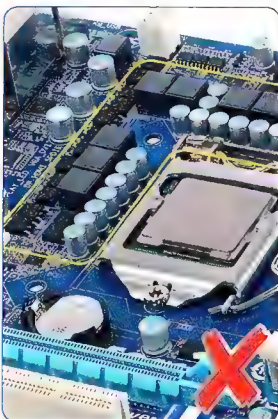
LOW-PROFILE HEATSINKS



While it's imperative that the chipset and VRMs are adequately cooled by heatsinks, some heatsink designers become a little carried away with sizes. Bigger is sometimes better, but excessive sizes can interfere with aftermarket heatsinks.

Look for: Clearly visible socket mounting holes.

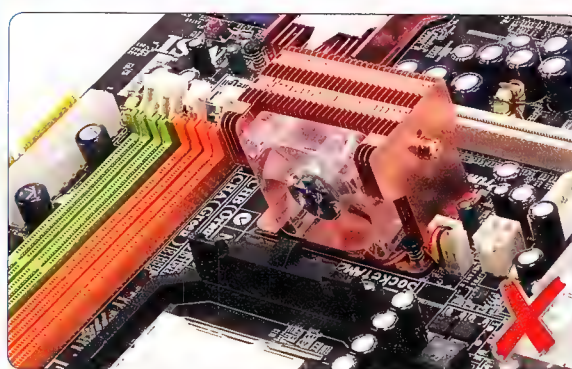
HEATSINKS ON VRMs



Although the VRMs won't be under much load in many PCs, overclocking will dramatically increase the amount of heat they need to dissipate. Heat is a significant problem for VRMs, as they become less efficient at higher temperatures and will quickly burn out and die if left inadequately cooled.

Look for: Heatsinks, preferably connected via heatpipes.

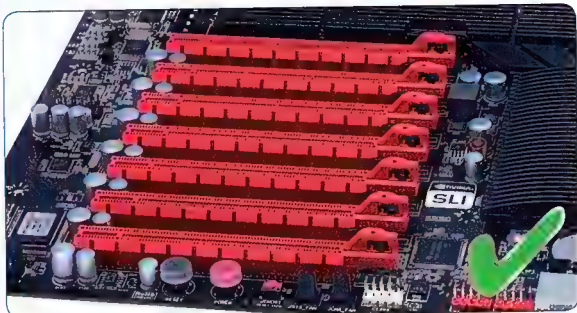
ACTIVELY COOLED HEATSINKS



Some chipsets churn through an impressive amount of power, which results in heat. While a fan can provide superior cooling over that of a heatsink alone, designers generally skimp on heatsinks – which use expensive copper or other metals – and merely add small fans (typically 40mm), that are hideously loud. The last thing you want is a noisy little fan spoiling your whisper-quiet PC, which can interfere with gaming and movies.

Look for: Adequate heatsink cooling without tiny fans.

PCI-E SLOT ARRANGEMENT



If you're planning on installing multiple expansion cards in your PC then it's crucial to check that the slot layout will be suitable. Graphics cards can take up two slots and require fresh airflow.

Look for: Two PCIe 16x slots, and PCIe 1x or PCI as needed.

24-PIN ATX POWER SOCKET



The power socket for the 24-pin ATX connector demands a huge amount of room on a motherboard, so its location is absolutely crucial if you want to build a tidy PC with optimal airflow. Some motherboard manufacturers locate the bulky 24-pin socket right in the middle of the PCB, which means the cable will pass directly into the exhaust flow from the processor, hampering cooling.

Look for: The socket at the edge of the PCB, facing outwards.

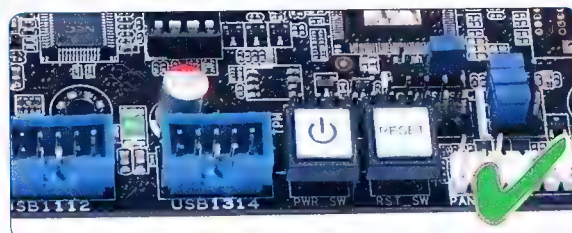
8-PIN EPS12V POWER SOCKET



Although the 8-pin EPS12V power socket has to be positioned close to the CPU socket, some manufacturers don't appear to have realised that locating it in the middle of the PCB is detrimental to airflow and tidy cabling. Some manufacturers also have the bad habit of burying this power socket among the heatpipes linking the Northbridge and VRM heatsinks, making it much harder to connect and disconnect the power cable once the motherboard is installed inside a case.

Look for: The socket at the edge of the PCB, facing outwards.

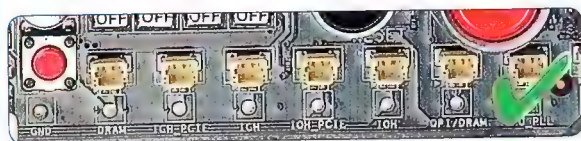
ON-BOARD CONTROLS



While most motherboards end up installed in cases, there comes a time when you'll need to troubleshoot – or overclock – outside of your case. On these occasions, you'll find that motherboards with on-board buttons and switches are considerably easier to use. Powering up, resetting and clearing CMOS this way makes the process of finding your stability sweet spot that much faster.

Look for: Buttons at the bottom or right edge of the PCB.

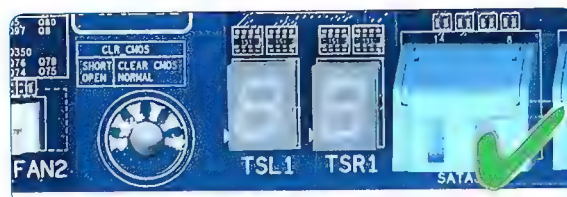
VOLTAGE MONITORING POINTS



Motherboard manufacturers aren't keen on handing out circuit diagrams, and finding out where to plug in a multimeter to determine the voltage of the different circuits on a motherboard is a major problem. It's useful to know how much voltage each circuit on the motherboard is actually delivering when overclocking, and though this is a non-essential feature, it can help reduce instability. If you know the actual voltage being supplied, you can adjust the setting in the BIOS to compensate.

Look for: A row of small pins to the edge of the board.

POST CODE DISPLAYS



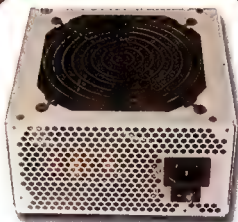
One of the best ways to troubleshoot a PC that won't boot is to take a look at the POST (Power on Self Test) code in which the system is sticking. These two-digit alphanumeric codes change every few seconds during the boot process as the motherboard initialises devices, so by looking up the appropriate code in the motherboard manual, you can find out which component is messing around, and begin to eliminate problems.

Look for: Two small grey boxes at the bottom edge of the PCB.

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HARDWARE

NEWS, REVIEWS AND ROUNDUPS ON THE LATEST HARDWARE

It started off a day like any other. Maybe a bit cold and windy for October, but haven't they all been? What it ended up was a dark day for tech; as in our cold, lonely labs, The Beast was powered down and pulled apart, forever. But we've allowed it to live on in a very special way - if you have a subs edition, that is...

We're still wearing black every day and

mourning our loss, but thankfully, every dark tunnel has a light of hope - and every day, more and more tech arrives in that very lab, crying out for attention and testing and, sometimes, love.

What are we to do, but buck up, consume a few energy drinks, and give it what it wants - benchmarks, and lots of them? To do otherwise would be unfair; to you, to the tech, to everyone!

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AMD RADEON 6870

Expect the very unexpected.

Street Price \$350 Supplier AMD

Product Page <http://goo.gl/kTa5>

Specifications 900MHz core; 1050MHz memory (4200MHz effective); 'Barts XT' core; 1120 stream processors; 1GB GDDR5; 256-bit memory interface; dual slot PCB with active cooling; dual 6-pin power connector

Card info www.techpowerup.com/gpuz/3q563

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Thirteen months have passed since the last wave of graphics technologies from ATI. As fate would determine, that would also be the last launch it would ever perform – as its parent company, AMD, has now completely engulfed the brand, and from this point onwards will be the sole name seen on these traditionally-red products. This launch is accelerated compared to the previous generation's incubation time of fourteen months, though AMD is promising continued dominance in a space fought between only two serious contenders. Can AMD maintain its hold on the performance crown for another year? The answer, as we found, is difficult – but it all starts with the 6870.

Smarter, smaller, sexier

Graphics technology is exceedingly complex. Though the eventual result appears to be simple – making games run faster – the path that must be walked to get there is not; it's more like

building a tower of matchsticks while balancing on a tightrope-thin budget that, at any moment, could be cut from underneath you. The path that the 6870 has taken is one whose depth cannot be explained entirely in this space, but we'll give it a quick summary for posterity.

It all began with the ATI 3870, a chip produced on the 55nm process that sported

what was then an impressively large 666 million transistors. It had 320 processing, or shader, units that did the bulk of its work, backed up by a mere sixteen Texture and Render units. Power consumption peaked at a cool 106 watts. This was followed by a spiritual successor in the form of the ATI 4870; itself based on the 3870's design. Though the manufacturing process was unchanged, processing units more than doubled to 800, with a huge boost to Texture units. Logic would follow that a more-than-doubling of integral parts of a core would result in a more-than-doubling in size; but transistors only rose by 44 per cent – due in large part to the efficiency gains developed by a highly dedicated engineering team.

Though the 4870 would go on to become one of ATI's biggest successes yet, development of its successor had already begun – even before the 4870 was launched. This was of course the 5870, and its impact was felt throughout the graphics industry with more force than had been seen since the launch of the NVIDIA 8800GTX – the 5870 was first to the market with DirectX11 and OpenGL 4.0 support, and was unchallenged for six months. It was a literal doubling again of shader units, and also managed to tweak the core clockspeed up to 850MHz. It retained the basic structure of the original RV770 core, but was without the load – though transistors increased by 44 per cent, well over a billion more, the power consumption was kept to a very manageable level. If the 55nm process was kept and not improved, temperatures could have broken 300W.

The 5870 has proven itself a successful card yet, and combined to sell over 2 million units. The launch in September of the 6870 would be just

ATI/AMD Graphics Processors

Graphics Card	ATI3870	ATI4870	ATI5870	ATI5850	AMD 6870
Processing core	RV670 XT	RV770 XT	RV870 XT	RV870 PRO	RV870 Derivative
Launch Date	November 19, 2007	June 25, 2008	September 23, 2009	September 30, 2009	October 22, 2010
Manufacture Process (nm)	55	55	40	40	40
Transistors (Billion)	0.666	0.956	2.15	2.15	1.7
Physical Die (mm ²)	192	256	334	334	255
Unified Shader Units	320	800	1600	1440	1120
Texture Mapping	16	40	80	72	56
Render Output	16	16	32	32	32
Reference Clock (MHz)	775	750	850	725	900
Memory Bus Width	256 GDDR4	256 GDDR4	256 GDDR5	256 GDDR5	256 GDDR5
Thermals Idle (W)	Unknown	Unknown	27	27	19
Thermals Load (W)	106	150	188	151	151
Card Length	23cm / 9"	24cm / 9.5"	28cm / 11.1"	24cm / 9.5"	25cm / 9.8"



same formula as the preceding members of the graphics space: but this is not the card anyone was expecting.

Texas mid-ranger

The 6870 is not a high-end card. It never will be, it never was, and it couldn't possibly be: a look at the Graphics Processors table (below -

preceding designs, and as seen in the core diagram (below), the first stage in the function of the card begins at the Command Processor. This assumes the role of traffic controller within the core, taking the flow of incoming cars, or data, and directing them down the appropriate lanes. It sends data first toward the Vertex Assembler, which in the 6870 causes

means the stage will be completed more slowly compared to a card with more units, such as the 5870.

These units appear in red in the centre of the core, and are labelled as 'SIMD Engines'. SIMD stands for 'Single Instruction, Multiple Data', and merely means that these units can process a single command - like drawing a game world - but work with multiple objects and features at any one time in a massively parallel way. The Vertex shaders are given instructions, called vertices, by the program being run, which they use to create a rough plan of where objects will be and where textures should be placed, working entirely within XYZ coordinate representations. There is no image drawn at this stage, only ones and zeroes kept in memory.

The car drives on with these XYZ coordinates to the Geometry Assembler, which takes the

The most damning nail in the coffin for the concept of a high-end 6870 comes from the Unified shader count, which sits at a mere 1120.

left) is all that's needed to explain why. The most damning nail in the coffin for the concept of a high-end 6870 comes from the Unified shader count, which sits at a mere 1120. Though clock speeds have been increased to 900MHz, this still represents a drop in shaders of 43 per cent; and Texture Mapping units fall, too, by the same proportion.

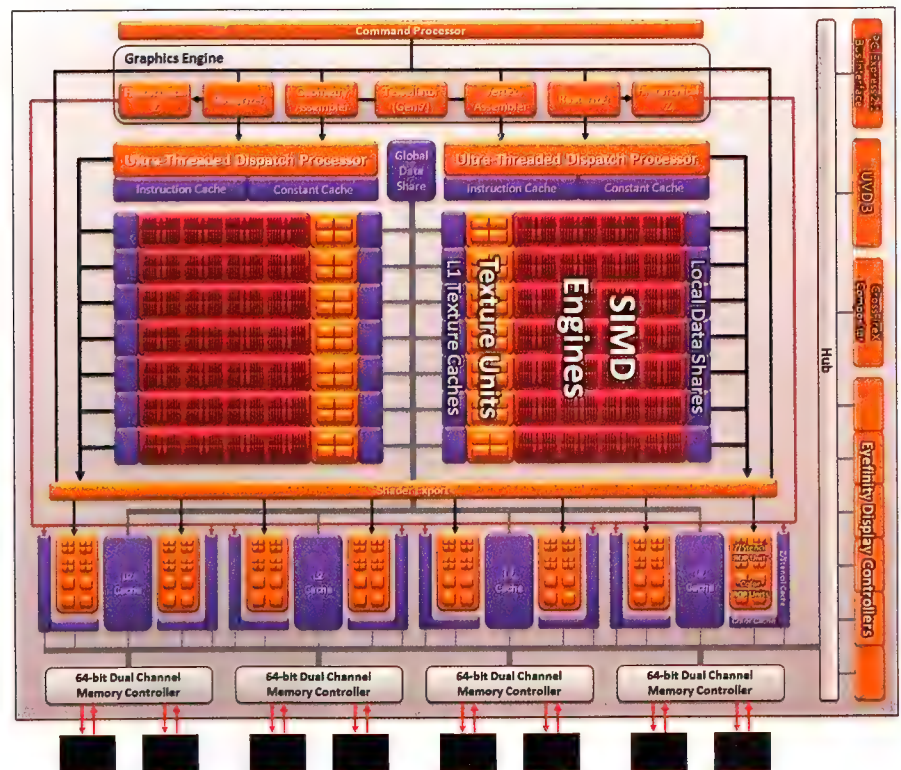
There have to be sensible reasons behind shifts such as this, and the foremost motivation for *reducing* processing units is the goal that ATI had been working toward with its earlier releases - power efficiency. The result of these changes is a die that takes up only 255mm², which allows many more 6870 cores to be produced at any one time, directly boosting both revenues and functional yields. A smaller die is like fitting squares onto an A4 sheet of paper - the smaller the squares, the more squares have, and the more you'll be able to sell (assuming customers pay the same per square, that is), resulting in higher revenues. Functional yields are the proportion of squares you can cut that are perfectly-formed, a number reduced by unavoidable manufacturing errors - the more cores or 'squares' you have, the less likely that you'll have a high number of errors.

So, let's take a look at exactly what these changes to the design of the core mean, and how it functions.

Core architect

The 6870 is based upon an unnamed derivative of the existing RV870 core, codenamed 'Barts XT'. Its architecture is therefore similar to the

the 1120 unified shader units to emulate Vertex shaders (relics from the early days of graphics technology). A reduction in overall shader units



Barts architecture diagram.



coordinate representations and effectively joins the dots between them, creating thousands of lines and triangles that fill in the blank spaces around coordinate data. The 1120 unified shaders in the 6870 change their function on the fly to become Geometry shaders, which create outlines of the shapes that will form the final image. DirectX11 and OpenGL 4.0 both support a technique that can be used at this stage called tessellation, which in the 6870 is performed by a dedicated Tessellator Engine. Tessellation works in tandem with the shaders to seriously boost the number of triangles created. It allows game designers to create a crude model of an object and write a simple displacement map, which the Tessellator Engine interprets and produces an object with an incredibly fine detail – and many thousands of triangles. While having more triangles doesn't sound too exciting, the result of this is much higher detail applied to objects and characters in the game world.

This stage doesn't quite create a great image to look at, but it does create a wireframe view of the world – with every object in a three-dimensional space. If we were to look at this on a two-dimensional monitor it would look like a white mess, as we look through a great many overlapping lines from foreground to background, but it's at this stage where a process called Hierarchical Z kicks in. The XYZ coordinates have already been filled in with lines and triangles at the earlier Geometry stage, with the underlying coordinate data still stored in memory, giving objects a left-right position (X), an up-down position (Y), and a front-back

position (Z). Hierarchical Z analyses each object's coordinate points for the values of Z that are closest to the front of the image – where the camera happens to be at the time – and erases the objects behind that point. The result of this is a wireframe image that only shows objects actually visible to the camera, and visually is somewhat recognisable as the end result.

The image still lacks colour and interest, though, so the car loads up with tessellated wireframe data (properly culled of excess Z information) and takes it to the final stage in the

graphics pipeline, the Rasteriser. It takes the data generated so far and looks into the memory for texture data to apply to the wireframe models, stretching colour information across visible triangles and between lines. This is performed by dedicated-function units within the core, and fills in the final piece of the colourless world, breathing life into the image.

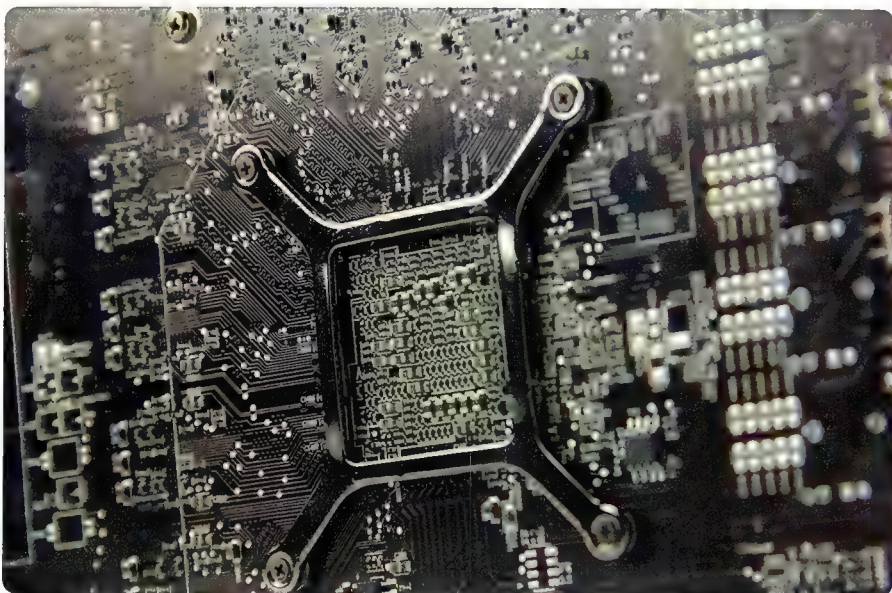
From here the car, now laden with all the construction and colour data it needs, moves on to exit the card, passing through the Eyefinity Display Controllers and onwards to the monitor, where all this work culminates in an image we can look at. It's a process that's repeated many times a second, and to hit the 60Hz refresh rate of most monitors, it must be completed in only 1/60th of a second. Impressively this can be done across three screens at one time from a single card, or multiple cards can work synchronously to achieve the same result, faster. The progress of the car can be summarised like this:

```
Command > Vertex Assembler
> Geometry Assembler > [DX11
Tessellation] > Hierarchical Z
> Rasterizer > Display
```

Special ops

The 6870 brings to the table a few features that we've already seen from either ATI or AMD, and the first of these hints directly at the nature of performance we can expect from future releases – the Tessellator Engine. Now in its seventh generation, this engine has been reworked extensively to become more competitive, and it's much faster than before. This can be seen in our *Unigine Heaven 2.1* benchmark, which we run at high resolutions with an extreme level of tessellation workload; the 6870 runs at 14.8fps while the nearest card based on specifications, the 5850, scrapes 11.8fps – even though the 5850 has more unified shader units available to it. The 6870 is effectively 25 per cent faster.

Impressively the 6870 also knocks the 5850 back in the same test with no tessellation,



the higher clockspeed clearly keeping the 6870 above board. Performance is identical between these two cards in *Lost Planet 2* at high resolutions with significant tessellation, showing that it's not the amount of shader units that matters – but the speed and size of your tessellation engine.

Other special hardware running in the 6870 core can be found on the sidelines, though their importance is as high as the tessellation engine. It's the third generation UVD, or Unified Video Decoder, which detects video workloads within the system and accelerates them without stressing the Central Processing Unit. UVD3 adds support for these codecs: VC-1, H.264, MPEG-2, MVC, MPEG-4 for DivX and Xvid. The most interesting of these is MVC, or Multiview Video Coding, which enables decoding of stereoscopic Blu-Ray discs.

The final piece of the puzzle is what AMD calls AVT, or Accelerated Video Transcoding. It utilises the UVD3 unit to decode the source video file, be it DVD-quality MPEG-2 or Full High Definition VC-1, and then uses the unified shaders of the card to encode the video file at a lower bitrate or resolution. It's a function that has been available since the 4870, but it's still a useful technology that has now been updated for the latest codecs.

Circus performer

The 6870 isn't all special-function units, and for many people it's the raw gaming performance that will be topping their list of reasons to buy – or avoid – this card. Thankfully it's no slouch in our benchmarks: in *Crysis* the 6870 returns average framerates of 39.45 compared to the 5850 at 36.18, a nine per cent performance improvement. This is an impressive result for a card that, on paper, does not appear to be significantly superior. *3DMark Vantage*, a synthetic benchmark, returns a score of P16579, while the 5850 only scrapes P14756, which is a 12 per cent improvement. The 6870 is overall ten per cent faster than the 5850.

However, the 6870 is not as fast as the 5870. It is beaten by P2027 in *Vantage*, by 3.64fps



in *Crysis*, and most significantly, by 9.8fps in *Unigine Heaven*. It is beaten in non-tessellated benchmarks by ten per cent, and is well and truly defeated with a 66 per cent gap in tessellated performance.

So the card is ten per cent above the 5850 and ten per cent below the 5870. How much faster can it be pushed?

Working overtime

Overclocking is a great way to get extra performance for free: a process where you artificially inflate the core clockspeed to make it work through tasks at a faster rate. We used our standard overclocking method of running a stressful graphics workload (*MSI Kombustor* or *Ozone3D Furmark*) and raising the frequency using *EVGA Precision*. The card was only able to be boosted by a disappointing six per cent on the core, though memory speeds improved by a nicer ten per cent. This overclock returned an improved *3DMark Vantage* score of P17528, a six per cent increase in performance. It's nothing to be sneezed at, but neither is it something

we'd say is essential to do; and it's still nowhere near the prowess displayed by the competing Fermi architecture. We had a closer look at overclocking online, at www.atomicmpc.com.au/?236115, where a reference 6870 card is dismantled to show its inner workings.

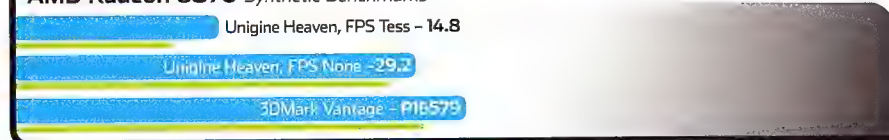
A winner?

You can find the 6870 knocking around store shelves for roughly \$350, which is a \$50 premium over the 5850 we know it replaces. It doesn't really run any cooler, and is significantly louder when under load. Its performance is ten per cent faster. The price is 16 per cent higher to get the new card, though this should smooth out once supply becomes more reliable. It's not a card that will blow your mind, nor push the performance bar any higher than we know it today, but it does help to swing price/performance back towards AMD – though you will get even better value from a GTX460 1GB. In all it's a launch that we weren't expecting, but we'd recommend hanging in there for next month: and the coming of the 6970... **JP**

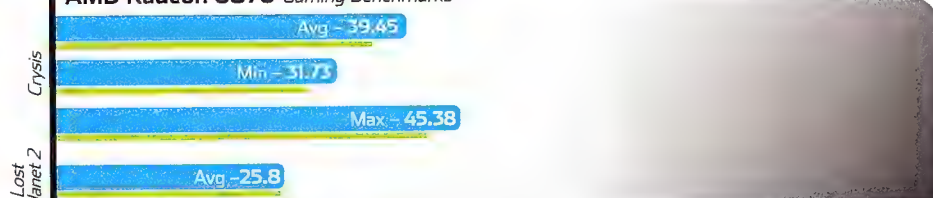
AMD Radeon 6870 Ambient readings



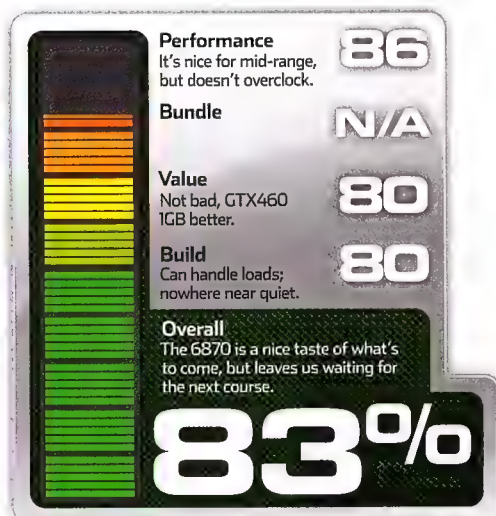
AMD Radeon 6870 Synthetic Benchmarks



AMD Radeon 6870 Gaming Benchmarks



Frames per second



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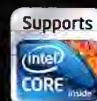
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AMD Phenom II X6 1075T

Not the chip you are looking for.

Street Price \$290 Supplier AMD

Website www.amd.com

Specifications 3.0GHz hexa-core; 45nm manufacturing process; 'Thuban' core; 6x128KB L1 cache, 6x512KB L2 cache, 6MB L3 cache; 15x locked multiplier; 125W TDP; AM3.

You can't live without food. Or air. Or energy drinks. And the same is true for your computer: there are simply a few bits it can't do without. This is one of those bits, and though a computer won't be able to compute without a processor, this is not one we'd recommend – but we'll explain why in a minute.

Functionally similar to the Phenom II X6 1090T that we looked at in Issue 114 (online at <http://goo.gl/m6GM>), the 1075T is cheaper and comes clocked slightly lower at 3.0GHz. The core architecture is identical, and features six processing cores based on the AMD K10 'Thuban' design – hence the hexa-core moniker. Each core has access to the same resources as those in the X4 range, with 128KB L1 cache, 512KB L2 cache, and a 6MB L3 cache that can be shared amongst the cores based upon their individual demands for working space.

This is in essence the same as a 1090T, though the most annoying change comes from

its positioning as a lower high-end chip – the unlocked multiplier of its older brother does not make an appearance in the 1075T. While we understand the manufacturing process well enough to know that not every chip will be an overclocking whiz, it's still quite disappointing, becoming even more so when looking at prices: you'll pay \$290 for a locked 3.0GHz hexa-core, but pay \$300 for an unlocked 3.2GHz hexa-core.

Why you'd skimp on ten bucks at this point is confusing and unintuitive, but we're here to tell you – don't!

If you do happen to buy the 1075T, you'll get the chip with its stock heatsink, and you'll have to pair it with a decent AM3 motherboard. Like all current desktop AMD chips the Phenom II processors are equipped with pins (938 to be exact) that slide into the corresponding holes of the motherboard socket. They're fragile, so don't drop the chip or bump it against anything on the way to the socket. While it's possible to tweeze the pins back into something resembling straight it's an un-fun experience – and that's with only a few pins out of whack!

We threw the chip at the board, where it stuck in the socket, and then slammed a heatsink down on top and got to testing. Though multi-threaded performance appears (as predicted) very nice, single-threaded performance was lacking. This appeared to be down to AMD's Turbo CORE technology, which is functionally similar to Intel's Turbo Boost, though not quite



as good. The 1090T was unashamed in its self-boosting, but the 1075T seemed reluctant to shift upwards for any length of time. The memory controller is still quite good, but it can't compete with the Intel offerings – and won't be able to until the launch of the Bulldozer architecture sometime next year.

Overclocking the 1075T wasn't as grand as we'd hoped, either, and it topped out at a speed of 4.02GHz. This was achieved with a HT bus speed of 268MHz and a core voltage of 1.42; the 1090T was able to be boosted to 4.28GHz.

Sadly this chip isn't as impressive as its older brother in performance, overclocking, or value. For those interested in taking the hexa-core route we'd point you either to the much-cheaper 1055T, or the more flexible 1090T – the 1075T just isn't worth the asking price. **JR**

Performance scaling

We ran Cinebench multi at different HT bus speeds, increasing increments of 5MHz from 240MHz to 265MHz. At these increments, the most efficient frequency was 265MHz, which gave the most points per HT bus speed, an interesting factor to keep in mind when testing for your 24/7 overclock settings. See the scores below:

20067 points / 240MHz = 83.613
 20531 points / 245MHz = 83.8
 20950 points / 250MHz = 83.8
 21438 points / 255MHz = 84.071
 21873 points / 260MHz = 84.127
 22302 points / 265MHz = 84.159

AMD Phenom II X6 1075T

	X6 1075T	200x15; DDR3-1333 7-7-7-21	217x15; DDR3-1446 7-7-7-21	230x15; DDR3-1532 7-7-7-21
PiFast	35.88s	33.40s	31.48s	
wPrime 32M – single thread	49.248s	45.213s	43.532s	
wPrime 32M – multi-thread	8.47s (5.81x efficiency)	7.849s (5.76x)	7.376s (5.90x)	
CineBench R10 64-bit – single thread	3518	3796	4032	
CineBench R10 64-bit – multi-thread	17010 (4.84x efficiency)	19016 (5.01x)	19310 (4.79x)	
Everest Read	8535MB/s	9152MB/s	9084MB/s	
Everest Write	6859MB/s	7427MB/s	7205MB/s	
Everest Latency	50.6ns	47.2ns	47.1ns	



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Specifications Socket AM3; AMD 890FX chipset; E-ATX form factor; 5x PCIe x16; 1x PCI; 6x SATA3; 2x SATA2; 2x USB3; DDR3-2133

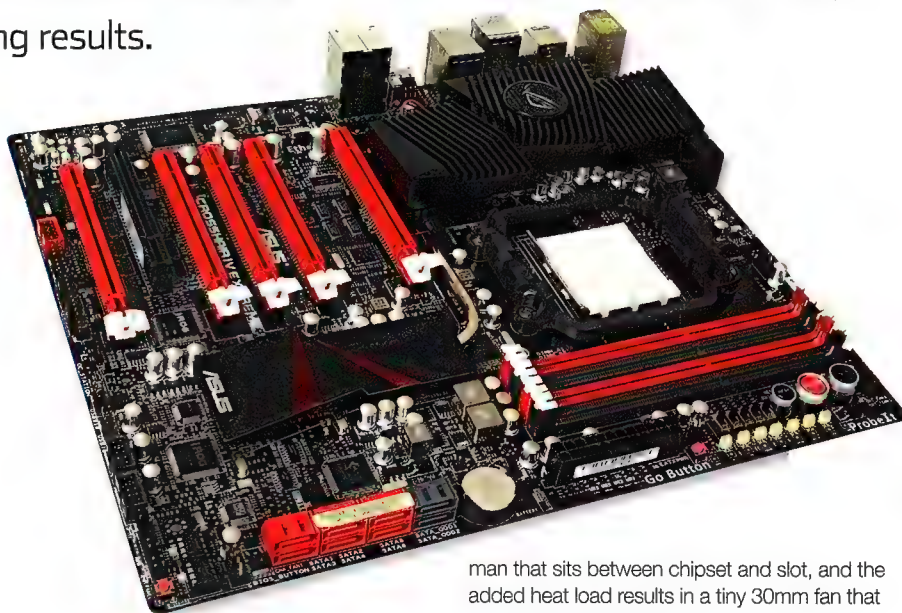
Product Page <http://goo.gl/RepS>

It can be nice to see hardware manufacturers taking risks on products. We're the first to admit when a gamble pays off, and though there's the potential to lose vast amounts of respect, not to mention revenue, boundaries have to be pushed by someone. It's just a shame that ASUS chose this one: SLI on an AMD platform.

The goal is innocent enough, and for long-time users of AMD processors who favour the NVIDIA flavour it may be a godsend. However the logic must be questioned when the motherboard's price is more than twice that of the lower-end ASUS M4A89TD-PRO, while boasting similar specifications. They both share the same 890FX Northbridge chipset and SB850 Southbridge, both have USB 3.0 added with the usual NEC chip, and both offer six SATA3 ports.

Comparisons continue when looking at the AM3 processor socket: the cheaper board uses a 6+2 power phase, while the Extreme uses an 8+2. Will the average punter be able to notice a difference? Probably not. There are always exceptions, of course, and if an LN2-crazed overclocking nut were to have a few hours with the boards they may see an improvement. But again, it's not too likely.

Clearance of aftermarket heatsinks appears to be identical, though the Extreme's power regulation heatsinks cover one entire side of the socket, potentially making installation harder. The socket is also slightly close to the DDR3 slots, and either standard-height sticks or a conservative heatsink must be used when all slots are filled. The Extreme does offer some nice enthusiast features above standard designs, offering voltage measurement points, hard power



and reset buttons, and dedicated PCIe lane on/off switches. The latter are perhaps most useful for those overclocking multiple graphics cards – on LN2 – and are used for troubleshooting dead cards. It's potentially helpful for non-crazy users, but of limited appeal to most.

Buttons we love... usually. Right next to the power button is a 'Core Unlocker' that, coupled with a 6-core CPU, adds butloads of instability and in our case, even de-activates a perfectly good core if you click it at the wrong time!

Where the Extreme makes the biggest change from a standard board is the expansion slots, which are boosted to take advantage of the full amount of lanes from the 890FX chipset. This means there are five full-length PCIe slots on offer, capable of native Crossfire up to three cards at 16x, or four cards at dual 16x and 8x.

The Hydra, infamously crippling the MSI Big Bang Fuzion and inflating its price to almost \$600 (seen at <http://goo.gl/FciX>), makes a flamboyant return here. Though the price isn't quite as astronomical, there are still design challenges faced by the addition of a middle-

man that sits between chipset and slot, and the added heat load results in a tiny 30mm fan that is nestled near the Northbridge in the cooling array – a really loud one.

Hydra technically brings SLI support to the board, but its cost can never justify the freedom granted; the board would be great on its own, but with the chip, it's far too backwards. We tested using two ASUS DirectCU GTX460 cards, which ran together without the use of an SLI bridge (a setup that always just feels wrong). 3DMark Vantage returned a score of P27863, a respectable result – and one that shows a 53 per cent improvement over a single card, at P18214. We also managed to get Hydra result of 33.39fps in Crysis, though this was disappointingly similar with a single card scoring 33.43fps.

The board does overclock well, Hydra aside, and we topped out at a stable speed of 268MHz. For those enthusiasts wanting SLI support, though, this is not the way to do it: go grab an X58 chipset and save yourself the hassle. 

ASUS Crosshair IV Extreme

	X61075T	200x15; DDR3-1333 7-7-7-21	217x15; DDR3-1446 7-7-7-21	230x15; DDR3-1532 7-7-7-21
PiFast		35.88s	33.40s	31.48s
wPrime 32M – single thread		49.248s	45.213s	43.532s
wPrime 32M – multi-thread		8.47s (5.81x efficiency)	7.849s (5.76x)	7.376s (5.90x)
CineBench R10 64-bit – single thread		3518	3796	4032
CineBench R10 64-bit – multi-thread		17010 (4.84x efficiency)	19016 (5.01x)	19310 (4.79x)
Everest Read		8535MB/s	9152MB/s	9084MB/s
Everest Write		6859MB/s	7427MB/s	7205MB/s
Everest Latency		50.6ns	47.2ns	47.1ns

Performance

It'll do your CPU justice.

90

Value

Dubious.

60

Features

Offers a lot for the serious enthusiast.

90

Build

Loud fan, Hydra somewhat useless.

75

Overall

Not a bad board, but it's not what we'd call perfect.

80%

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ZOTAC GTS450 AMP! EDITION

Doesn't quite get to eleven.

Street Price TBA Supplier Zotac

Website <http://goo.gl/KNft>

Specifications 875MHz core; 1000MHz memory (4000MHz effective); 1750MHz shader; GF106 'Fermi' core; 192 CUDA Cores; 1GB GDDR5; 128-bit memory interface; dual slot PCB with active cooling; 6-pin power connector
Card info www.techpowerup.com/gpuz/65fv7

In a growing trend that suggests NVIDIA partners are happily taking advantage of the design freedom offered them by the green giant at the launch of the GTS450 card, Zotac have launched their Amp! Edition alongside a wave of competing designs – each bringing their own unique ideas to the table. With the landscape muddled by so many sets of footprints, all walking their own directions, we followed this one to its conclusion – but if you're an enthusiast worth your salt, you won't be too impressed.

The engine running at the heart of the Amp! is the NVIDIA GF106, a budget graphics processor that is charged with a piddling complement of 192 CUDA Cores. These cores are factory overclocked by 92MHz, which represents an increase of 12 per cent. This isn't as impressive as the Gainward GTS450 GS from Issue 118, which was clocked much higher at 930MHz. Memory speeds receive a slight boost from a reference 902MHz to 1000MHz, and the 1GB of GDDR5 chips function at an effective 4000MHz due to the quad-pumped design. Overclocking the memory was an odd choice in retrospect; the memory bus is only 128-bits wide, and can't begin to touch the speeds achieved by higher-end graphics cards.

The situation becomes noticeably stranger when considering the lack of pricing information available for this Zotac model. Though the Amp! Edition is not listed online for sale, the standard

8% OC



Zotac GTS450

can be had for \$180.

Extrapolating out and allowing for an overclock would place the Amp! at something closer to \$220; the aforementioned Gainward is a humble \$165, and is higher-clocked to boot.

Giving the Zotac the benefit of the doubt and ignoring that for now, we threw it at our graphics testrig and gave it a run through our benchmark suite. Unsurprisingly the Amp! scraped lower performance results in both Crysis and Lost Planet 2, though in each case the difference was less than a frame a second. Heaven under an extremely tessellated load produced a similar margin of change, though 3DMark Vantage performed slightly in the Zotac card's favour. We imagine this is due to updated drivers more than anything, and isn't very surprising – though it's a point in favour for keeping up-to-date!

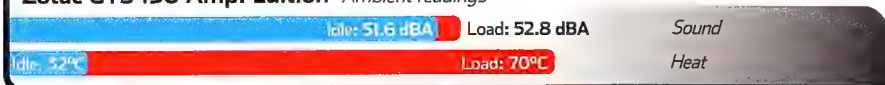
With performance failing to impress us we took our usual temperature measurements – idle measured at Windows 7 desktop after a

3DMark Vantage run has had time to hit equilibrium, and load measured during the final stages of our Crysis tests – perhaps the card could win us back over yet? Annoyingly we found the opposite result: the Amp! idled slightly warmer than the Gainward, though peaked one degree cooler at load. Zotac does manage to scrape back a few points in the silence stakes, idling at 51.6dBA that barely increases under load to reach 52.8dBA.

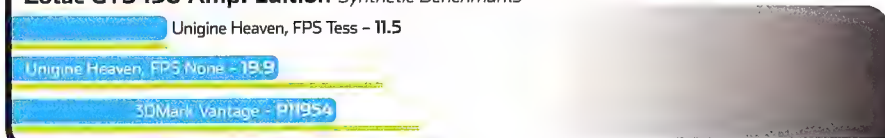
This is such a slight difference that we can effectively give it an overall stamp of "inoffensively quiet". The only other area of distinction worth mentioning are the display outputs, which comprise two DVI, one HDMI and a DisplayPort connector. Nothing particularly out of the ordinary, though it's nice to have a little flexibility.

The GF106 core fills in a void that very few readers really care about – not fast enough for high-end gaming, nor power-conscious enough to be a great small form-factor choice. This iteration of the GTS450 costs too much to tempt, and can't back up the price with performance enough to give it any appeal. **JR**

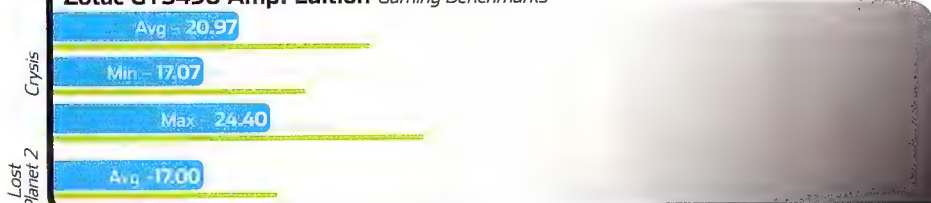
Zotac GTS450 Amp! Edition Ambient readings



Zotac GTS450 Amp! Edition Synthetic Benchmarks



Zotac GTS450 Amp! Edition Gaming Benchmarks



= Reference scores: XFX 5850

Frames per second

Performance

Average overclock, uninteresting performance.

Bundle
Cables and manual, little else.

Value
We just can't justify the likely cost.

Build
A touch warm, but very quiet.

Overall
It needs to offer more than this.

68%

OCZ Vertex 2 240GB E Series 3.5in

No brackets in sight.

Street Price \$620 Supplier OCZ Technology
Website www.ocztechnology.com

Specifications 240GB (223.57 formatted); SandForce controller; SATA2 interface; 3.5" form factor



Solid storage is definitely a deluxe product, yet has been hampered by low storage capacity and very high prices – only a few months ago we would've seen 100GB go for \$500 – though that situation appears to be changing. Through a combination of our very strong economy and mass production of flash storage chips, it's now possible to buy more than double the flash memory for only \$620. This represents a new value of \$2.77 per usable gigabyte, compared to the earlier, higher prices of \$5.37 per gigabyte.

The base specs of this particular drive are not exactly unique, though the use of a Sandforce controller gives the Vertex 2 3.5in the highest performance afforded through the current (limiting) SATA 2 bus. Physically the drive fills a 3.5in bay, rather than the

usual 2.5in, meaning it can be installed in all cases without requiring an adaptor bracket or awkwardly mounting it behind the motherboard tray.

Performance of the drive in HDTach is the highest again in SATA 2 SSD speeds, matching the smaller version of the drive (online at www.atomicmpc.com.au/?232675) with an average transfer speed of 236.4MB/s, and a burst of 259.6MB/s. Though performance does drop when the drive is full, to 194.1MB/s average read, TRIM support slowly returns the drive to normal speeds; formatting takes 55 seconds when chockers. CrystalDisk also shows impressive speed, with write speeds very nice.

SSD prices now, more than ever, make the leap to SSD ownership more attractive; and until SATA 3 controllers hit, this is one of the best. JR



Ozone Radon 5K

An attractive and solid mousing option.

Street Price \$75 (TBC) Supplier Ozone Gaming
Website <http://www.ozonegaming.com>

Specifications Philips PLN 2032 laser sensor; 8 buttons (7 programmable); 100 – 5600 dpi resolution (four settings); removable weights (5gm).

Ozone's a relative newcomer to Australian shores. As of writing, the company is still confirming an Australian distributor, but they're keen to crack the market, and to that end we've got the not quite so shiny new Radon 5K mouse to play with.

Not that there's anything wrong with the lack of shininess – it's a lovely matte black rubber finished mouse, with a rather wider than average footprint under the hand (if you get our meaning). An attractive O3 logo and a set of red LEDs to denote your chosen dpi settings offset the black. Completed by a nice long cloth-wrapped cable, the Radon is certainly an attractive package.

There's a hint of cleverness at play, too. Under the mouse is a multi-channel cable run that lets you re-arrange where the cable exits the underside – great if you've got a cramped mousing surface, or are a left-hander. Though, left-handers might find the asymmetric, right-

handed leaning Radon a less than perfect choice on basic ergonomic principles.

All that said, the Radon's let down by one of our pet hates in gaming mice – an off-center laser sensor.

You might be different, but we mouse with the heel of our hand planted on the desktop, using it as a kind of fulcrum around which all our movements depend. As such, lateral mouse movements on an off-center sensor cause a diagonal tracking of the cursor, rather than a truly flat lateral movement. If there's one thing that's going to throw off quick, reflexive aiming, this is it.

It certainly did that with us, which is a shame, as otherwise it would be a killer choice – easily matching the performance of our stock Razer Lachesis. It's not got the best software, though, but we rarely spend too long working on macros anyway, so that's not a huge detraction.

It's a bit of a mixed bag, and at the likely price it's going to sell for, a lot to ask. It is a tops performer, though, if you can ignore the sensor placement, but whether or not it's the right mouse for you... only you can really say. DH



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In Win Dragon Slayer

A budget mATX case that's somehow managing to punch well above its weight...

Street Price \$100 **Supplier** In Win
Website www.inwin-style.com

Specifications 430 x 196 x 426mm (HxWxD); 3x 5.25in drive bays (external), 1x 3.5in bay, 1x 2.5in drive bay; 1x 140mm fan (top), 1x 140mm fan (front), 1x 90mm fan (rear), 1x 90mm fan (front); 5x expansion slots; 1x USB 3, 2x USB 2, 1x audio; mATX.

We really do wish we could say we've had a love/hate relationship with In Win over the years, but to be brutally honest... it's always been more of a dislike/hate relationship. The case and peripheral maker has always been known for focusing on the cheap side of the cheap-and-cheerful-moniker, and we've more often than not simply refused to let any of its gear into the Atomic labs.

That, however, has changed with the coming of the dramatically-named Dragon Slayer, an mATX case with some grand stylings and a surprising amount of cool features. Of course, for every feature that impresses, there's one or two that does the exact opposite and really grinds our thumbscrews.

How does that balance up at the end of the day? Well...

Externally, the Dragon Slayer delivers some serious visual impact. Built from black and grey metal with grey and clear plastic highlights, the whole case has an almost ruggedised look to it. Gunmetal mesh on the front fascia and side panel is offset by a second, tighter black mesh layer beneath. Sadly, none of it's filtered, but the double layer does provide a bit of protection. For the full visual impact, turn the box on – the In Win logo and power buttons light up brighter

than the sun. It'll be over the top for some, but it only adds to the ruggedised, almost military look.

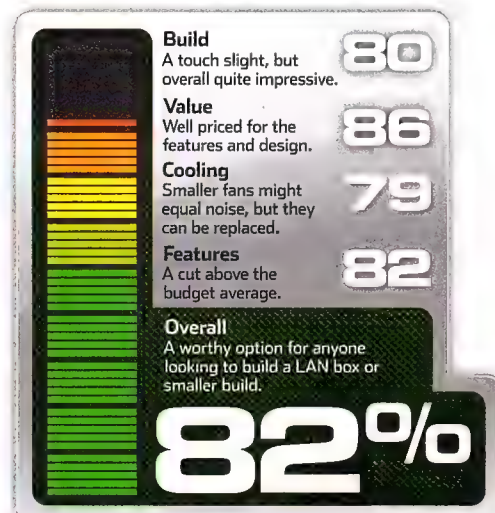
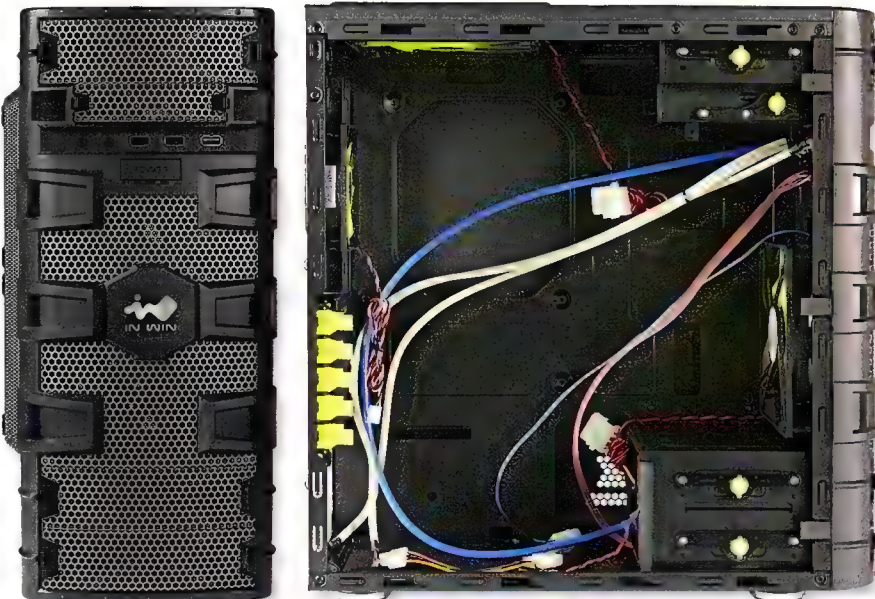
Taking off the sidepanel for a peek at the internals, however, revealed one of our most hated things in PC case design: plastic thumbscrews. These horrid little lumps of poorly designed plastic are an upgrader's nightmare. Prone to tearing themselves apart after a few uses, they just scream cheapness. Thankfully, any seriously regular builder probably has scads of proper solid metal thumbscrews to replace the dodgy plastic ones, but the choice to go so cheap still leaves a bad taste in our mouths.

Regardless, with the side panel off, the Dragon Slayer is pretty impressive. The black interior is surprisingly roomy given it's mATX form factor, and makes use of some clever build options. There aren't a lot of drive bays, but those you do get are cleverly built. There are two 3.5in bays that sit at the bottom of the case, that can house drives using some neat rubber-grommetted rails; but you can also unclip the interior caddy to expand these bays to two 5.25in ones if you need the option. At the top of the case is another 3.5in bay, and a 5.25in one, and slung under these bays is a mount for an SSD. It's overall a very neat design that gives system builders a lot of flexibility.

The mobo plate is similarly well-designed, with a CPU cutout, integral standoffs, and a roomy area behind the plate for stowing excess

cabling. If you need more cooling, there's also four 120mm fan mounts on the side-panel, and these are also rubber-grommetted to keep noise down. The interior's roomy enough for a full length video card – making this a pretty good LAN choice – but full height coolers don't quite make the cut. There's a tool-less system for clamping expansion cards in place, but it's thankfully removable; and even In Win admits it's not up to securing high graphics cards.

We like the Dragon Slayer. It's not perfect, but it's certainly the closest we've seen In Win come to enthusiast-grade material in some time, and it's a great option for anyone looking to get into mATX system building. **DH**

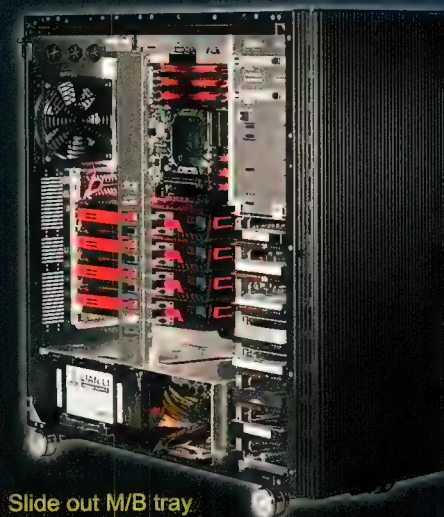


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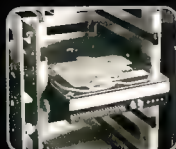


Slide out M/B tray

PC-V2120

Bay: 5.25" x5 (Can be convert to 3.5" internal x 3),
3.5" internal x10 (Can be convert to 2.5" x 5), 2.5" internal x 2
M/B: HPTX / E-ATX / ATX (Slide out M/B tray)
Fan: 3 x 140mm, 2 x 120mm
I/O Ports: USB 3.0 x 4 / E-SATA x 1 / HD Audio
Dim.: 235 x 620 x 635mm (W, H, D)
PCI: 11 Slots
Color: Silver / Black / All Black

SILENT



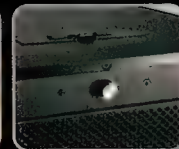
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PC-V2120

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2.5" internal x 1
M/B: ATX, M-ATX
Fan: 2 x 120mm
Dim.: 210 x 450 x 490 (W, H, D)



PC-V352B
Bay: 5.25" x 2, 3.5" x 1,
3.5" internal x 3
M/B: M-ATX, Mini ITX
Fan: 2 x 120mm, 1 x 80mm
I/O: USB3.0 x 2, E-SATA, HD Audio
Color: red / black / silver

PC-Q08
Bay: 5.25" x1, 3.5" internal x6,
2.5" x1
M/B: Mini ITX
Fan: 1 x 120mm, 1 x 140mm
I/O: USB3.0 x2, HD Audio
Color: red / black / silver

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T60
Bay: 5.25" x 2, 3.5" x 3, 2.5" x 2
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MSI GX660R

Boom boom, shake the room.

Street Price \$2500 Supplier MSI

Website <http://goo.gl/hFoC>

Specifications Intel Core i7-720QM (1.6GHz, 6MB); 3x4GB DDR3 1066; 2x500GB HDD RAID0; Blu-ray combo; ATI Mobility 5870 (800SP, 1024MB GDDR5 @ 128-bit, 700MHz core/1000MHz mem); 15.6" LED LCD (1920x1080); 802.11b/g/n; Windows 7 Pro x64; HD webcam; 2x USB3; 3.5kg.

Gaming laptops are quickly becoming more awesome as time passes. From their early days of awkward chunkiness comes a new generation of high-powered semi-mobile computers that contain everything you need for a good time, in a package you can take over to your mate's house.

The GX660R is quite manageable in size, and the 15.6in LED-lit LCD screen boasts an impressively sharp image – with a 1920 x 1080 resolution to boot. Though colours lack contrast, the screen itself is perfectly good for watching movies, and the included Blu-Ray drive gives you no excuse not to. Also making its debut here are the Dyna Audio speakers that MSI told us about at Computex some months ago (in our second podcast at www.atomicmpc.com.au/Podcast), whose biggest drawback is their origin of manufacture – a car audio design house.

Though we were initially sceptical that internal speakers could have sound we'd actually consider listening to for more than five minutes, much less laptop speakers, we quickly warmed to the GX660R's impressive sound. Voices in particular are clear and detailed, and the *Avatar* trailer showed a very convincing sound-stage

for a mere 2.0 system. They do get a little muddled when dealing with multi-layered tunes from the heavy metal, rock or techno genres, but games and movies are right at home here – and the volume is more than high enough to fill a small room with sound.

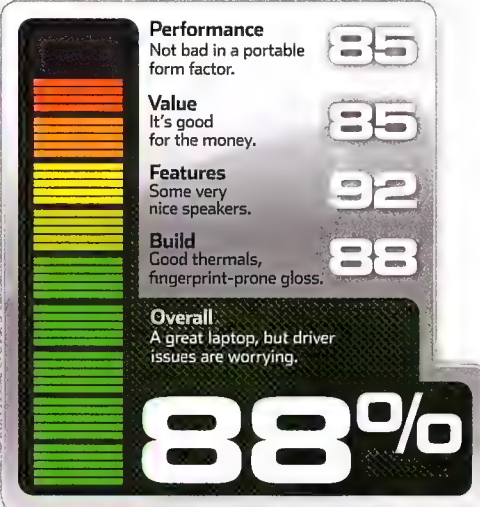
The good news doesn't end there, with tech specs showing that the GX660R has some mostly-good choices within. An Intel i7-720QM runs at 1.6GHz stock, but Turbo Boosts itself up to 2.8GHz briefly when running single-threaded workloads. The processor is backed up by a somewhat overkill memory allotment of 12GB, with three 4GB DDR3 sticks that will never be completely utilised unless editing HD video. This combination of components returns a Cinebench score of 3790 points when single-threaded, and 10373 points when running multiple threads – exactly where we expect it to sit.

Hard drive space is provided by two 500GB disks that are factory configured to run in a RAID0 stripe, and partitioned to offer two roughly equal spaces. This is easy to miss and assume there are two drives – but if one fails, all the data will be lost on both partitions. Speeds are nice enough, with an average read of 116MB/s and random access of 15.2ms, but a single SSD will trounce that by a large margin – we'd suggest replacing one of the drives and running without RAID if you're serious about storage speed.

Graphics are provided by what is labelled a '5870 Mobility', but what is in actuality a 5770. As such the performance isn't what we'd expect from a desktop, and in our Crysis test it pulls only 18.85 average frames per second. On lower settings this is certainly more than playable, though, and it's close to the best you can get in a lappy. 3DMark Vantage gives a score of P8115.

Physically the lappy isn't too heavy at 3.5kg, and nor does it get too hot. Running OCCT and Furmark concurrently for ten minutes produced GPU temps of 96 degrees and CPU temps of 76, with a whooshing of the exhaust fan. We noticed that the CPU sat at 1.73GHz the entire time, and the keyboard remained cool enough to touch.

Annoyingly the official mobility graphics driver from AMD refused to install, and as we'd re-installed Windows 7 x64 Pro on the lappy, wireless drivers hosted on MSI's site refused to function. This is worrying, but assuming you never need to mess with the OS (there are a few out there who like things at stock) and want a fast laptop with great speakers, then this is a great choice that just falls short of an award. **JP**



What's

COOLER than being COOL?

James Gorbald and Antony leather put the heatsink to the processor in a ten-way mashup of capable cooling.

Changing the CPU cooler is one of the cheapest and easiest upgrades you can make to your PC. With summer just around the corner now that spring temperatures are beginning to rise, it's a good time to invest in some new gear. After all, you can pick up one of the third-party CPU coolers reviewed in this Head2Head from as little as \$46, and even the most complex takes less than half an hour to install.

Upgrading the CPU cooler can massively improve your PC in several ways. Firstly, almost every third-party CPU cooler can cope with more watts than the reference Intel and

AMD coolers, so upgrading will lower the temperature of your CPU. This is a good thing, as a cool CPU will last longer than a boiling chip. Secondly, if your CPU temperature is low enough, you'll be able to overclock the CPU and boost its performance. In addition, third-party CPU coolers are generally a lot quieter than the reference Intel and AMD coolers; and nobody likes a noisy PC.

So without further ado here's our roundup of ten different CPU coolers, all of which promise, in one way or another, to improve your PC. Can they live up to their extravagant claims? We find out over the next 12 pages.



How We Tested

The single most important characteristic of an HSF, or HeatSink and Fan, is how effectively it cools your CPU and prevents the automatic thermal protection from throttling the CPU (reducing its frequency, and therefore its performance) or worse still, automatically shutting down your PC.

For this Head2Head we wanted to accurately measure the CPU temperature of our test rigs when each new HSF was installed. For this purpose we use the freeware application CoreTemp (www.alcpu.com/CoreTemp). This application reads the temperature of the DTS, known in full as the Digital Thermal Sensor, which is embedded in the core of every modern CPU. This means that the DTS gives a much more accurate reading than a third-party temperature sensor, since its readings aren't affected by sloppy BIOS programming or a poorly calibrated external health monitoring chip on the motherboard.

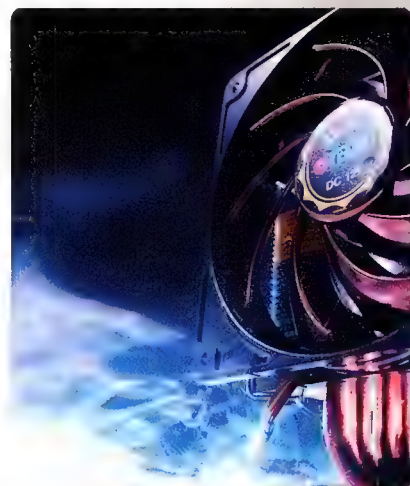
We don't have access to a perfectly temperature-controlled environment in the Labs, and although CoreTemp can display the temperature of each CPU core, it's more accurate to measure the delta T between the ambient and CPU temperatures – in other

words, how hot the heatsink was compared to the room. This means that HSFs tested on different days, when the ambient temperature may have varied, can be fairly compared with one another.

The key question when choosing a new HSF is whether it's cooler or quieter than the reference HSF. While the reference HSFs aren't the most powerful coolers, you effectively receive them for free when you buy a retail boxed CPU. As such, it's only worth considering a third-party HSF if it's better in some way than the reference HSF. With so many different types of CPU available, we built three thermal test rigs to cover the three main platform types: Socket AM3, LGA1156 and LGA1366. The Socket AM3 test rig comprises a 3GHz Phenom II X4 940 Black Edition overclocked to 3.6GHz, with the vcore boosted to 1.6V in an ASUS M3A78-T motherboard. The LGA1156 test rig comprises a 2.93GHz Core i7-870 overclocked to 3.6GHz with a vcore of 1.35V in a MSI P55-GD65. The LGA1366 test rig comprises a 3.2GHz Core i7-Extreme Edition overclocked to 3.6GHz with a vcore of 1.3V and a Biostar T-Power X58A motherboard. All three test rigs are built inside a SilverStone PS03 midi-tower

cases and include an Nvidia GeForce 9600 GT graphics card.

The temperature results shown on the graphs were taken with the CPU at idle on the Windows desktop, and once the CPU had reached its maximum stable temperature running the smallfft test in Prime95. The temperatures shown are the delta T between the ambient and CPU temperatures.



Heatsink comparison

	Cogage Arrow	Cooler Master V6-GT	CoolIT Eco ALC	Corsair A70	Corsair H70
Price	\$75	\$80	\$108	\$100	\$170
Socket Compatibility	775 / 1156 / 1366	775/ 1156/ 1366 & AM3	775/ 1156/ 1366 & AM3	775/ 1156/ 1366 & AM3	775/ 1156/ 1366 & AM3
Fans (included)	120mm	2 x 120mm	120mm	2 x 120mm	2 x 120mm
Fan speed (rpm)	Not stated	800 - 2,200	1,800	1,600 or 2,000	1,600 or 2,000
Fan speed control	PWM	PWM	Manual	Manual	Manual
Dimensions (mm) (W x D x H)	123 x 147 x 160	120 x 131 x 165	Not stated	129 x 125 x 160	Not stated
Thermal interface material	Chill Factor	Cooler Master	CoolIT Systems Pro A.T.C.	Corsair A70	Pre-applied

Heatsink comparison

	Prolimatech Megahalems	Scythe Yasya	Thermalright IFX-14	Thermaltake Frio	Zalman CNP510X Performa
Price	\$75	\$70	\$115	\$78	\$46
Socket Compatibility	775/ 1156/ 1366	775/ 1156/ 1366 & AM3	1366	775/ 1156/ 1366 & AM3	775/ 1156/ 1366 & AM3
Fans (included)	N	120mm	N/A	2 x 120mm	120mm
Fan speed (rpm)	N/A	470 - 1,900	N/A	1,200 - 2,500	900 - 2,000
Fan speed control	N/A	Manual or PWM	N/A	Manual	PWM
Dimensions (mm) (W x D x H)	130 x 74 x 159	130 x 109 x 159	146 x 124 x 161	139 x 98 x 165	132 x 100 x 152
Thermal interface material	Unbranded	Unbranded	CF2	Thermaltake	ZM-STG2

Cogage Arrow

A quiet heatsink for Intel processors.

Street Price \$75 Manufacturer www.enermax.com

Heatsink Material Nickel-plated copper base, Aluminium fins



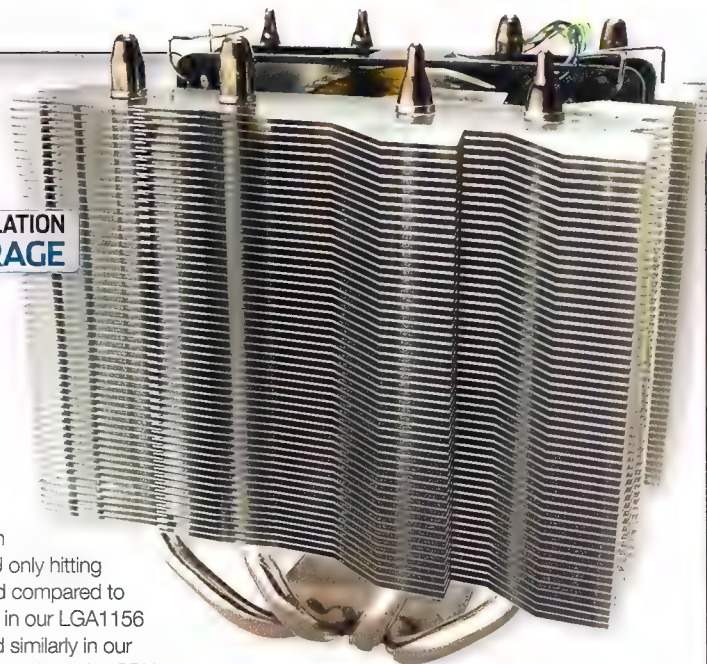
The Cogage Arrow is an enormous cooler with four 8mm heatpipes and space for up to three 140mm fans, although it includes only one 120mm fan in the box. The only CPU type we weren't able to test it on was Socket AM3 – it's only compatible with Intel Socket LGA775, LGA1156 and LGA1366. There's an optional mount for AMD CPUs, but we weren't able to locate one. The Arrow didn't prove to be too difficult to mount, and shouldn't necessitate uninstalling the motherboard, as long as your case has the CPU socket area cutout.

The process is simple: two mounting brackets secure a backplate to the motherboard; a large mounting plate then straddles the heatsink and fastens to the mounting plate using two spring screws. It's slightly trickier than the likes of the Corsair H70, but nowhere near as frustrating as the Cooler Master V6-GT. The Arrow's fan

relies on PWM for speed control, but even so, it was extremely quiet.

Even more remarkable was that it provided excellent cooling with a single fan, the CPU only hitting 4°C higher under load compared to the Thermaltake Frio in our LGA1156 testbed. It performed similarly in our LGA1366 test system, where the CPU was just 3°C hotter than the Corsair H70 and Thermaltake Frio, both of which managed a delta T of 47°C.

The Arrow is a monster of a cooler that should be near the top of your shopping list if you want a quiet PC. It isn't as compact or good at cooling as the Thermaltake Frio, but it's much quieter and has room for more fans too. Just make sure your case has enough space for it. **AL**



CoolerMaster V6GT

A noisy pain to install, but performance is tempting.



Street Price \$80 Manufacturer www.coolermaster.com

Heatsink Material Nickel-plated copper base, Aluminium fins



The V6-GT is the newest entrant into the CoolerMaster V-series of heatsinks, and it definitely feels compact and powerful, though it lacks the fan controller of the bigger (and more expensive) V8.

Mounting is the wrong word for securing the V6-GT to your motherboard; the process is closer to a juggling act involving a ridiculous number of flaming chainsaws that require assembly before you can even think about

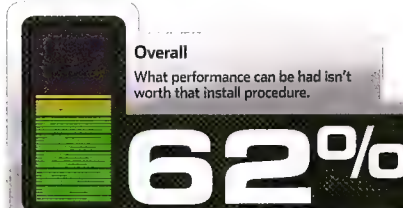
dealing with those hungry lion zombies. While you only have to carry out this procedure once, the V6-GT is a good way to destroy any leftover excitement you may have had when you bought the cooler. In addition, we find that a higher number of parts make it more likely for something to go wrong.

Fortunately – although not without experiencing some frustration – we were able to mount to our CPU on the first attempt. Unfortunately, noise levels were less than pleasing, with no manual fan control available. At full fan speed, without PWM interfering, the V6-GT was incredibly loud compared to coolers such as the Cogage Arrow. This noise did at least translate into some excellent results in cooling our test system CPUs though.

It cooled the CPU by 17°C more than the AMD reference cooler in our Socket AM3 test system, and was only pipped to the post by the

Corsair H70 and Thermaltake Frio by a couple of degrees. It was a massive 39°C cooler than the reference LGA1156 cooler. However, the Thermaltake Frio was again slightly cooler with a delta T that was 4°C lower. It was a similar story with our LGA1366 test system where the V6-GT was 24°C cooler than the reference cooler, but it lagged behind the Frio by 4°C.

The V6-GT is much more expensive than the competition. It's also noisy and very awkward to mount, so we simply can't recommend it. **AL**





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CoolIT Eco A.L.C.

Great value watercooling, defeated by heatsinks.

Street Price \$108 Manufacturer www.coolitsystems.com
Heatsink Material Copper base, copper tubes/aluminium fins



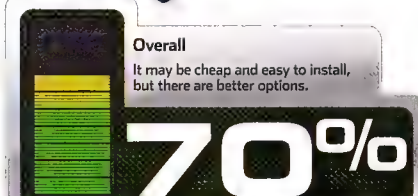
The CoolIT Eco ALC uses liquid to cool the CPU, and while it probably isn't water, it's certainly wetter than standard heatsinks. It has a single, relatively quiet 120mm fan mounted to a half-thickness 120mm radiator. This isn't usually enough to provide decent results with modern CPUs, especially if they're overclocked, but we pressed ahead anyway.

It's compatible with Socket AM3, LGA775, LGA1156 and LGA1366 motherboards, and is incredibly easy to install, with a single hold-down plate securing it to a backplate using thumbscrews. The only issue is the fixed length of tubing between the radiator and the combined pump and CPU waterblock. In our small test case, a fair amount of force was needed to squeeze everything in. Thankfully, the bars didn't show any signs of breaking. You also need to consider how close the nearest 120mm fan mount is to the socket CPU, and how much space is present around the fan mount. For example, motherboards with very tall VRM heatsinks and narrow

cases may be unable to accommodate the Eco ALC.

The Eco ALC cooled the CPU by just 5°C more than the reference cooler in our Socket AM3 system – a poor result for any CPU cooler. It fared better in our LGA1156 test system, managing a CPU delta T of 42°C – 34°C below that of the reference cooler. However, even this isn't a all that good result when you consider that air coolers such as the Thermaltake Frio shaved a further 9°C off the Eco ALC's delta T. It was a similar story with our LGA1366 test system, with the Eco ALC recording a delta T of 58°C, which is cooler than the reference cooler, but 11°C hotter than the competition.

The Eco is a cheap and easy way to water-cool your PC. Unfortunately, its small radiator means it's nowhere near as quiet or cool as a high-end custom water-cooling kit; nor is it able to keep up with high-end air coolers. **AL**



A half-height radiator with a single fan isn't enough for a water cooler to be able to compete with modern air coolers. The H70, however, includes a full-sized single 120mm-fan radiator and two 120mm fans. Corsair has also improved the copper cooling plate, also known as water block, since the original H50.



Installing the H70 is very easy, with a single mounting bracket securing to a backplate behind the motherboard. The cooling plate then slots underneath the mounting bracket to give a firm grip on the CPU. The only issue we had with the H70 was the proximity of the 120mm rear fan mount to the CPU socket, which meant that it was a bit of a squeeze to fit everything into the case.

The H70 does include two fan-speed reduction cables, which are very welcome, as it's quite noisy with the fans at full speed.

The H70 was just 1°C hotter than the best-performing heatsink in our Socket AM3 test system, and managed a delta T of 36°C in our LGA1156 test system, only slightly hotter than the Frio and 40°C cooler than the reference cooler. It was joint first with the Frio in our LGA1366 test system with a delta T of 47°C – 28°C cooler than the reference cooler. The temperatures didn't increase by more than a few degrees with the fans at low speed either.

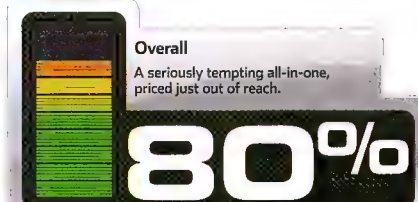
Corsair H70

An impressive, if expensive cooler.

Street Price \$170 Manufacturer www.corsair.com
Heatsink Material Copper base, copper tubes/aluminium fins

The instructions indicate that the fans should draw air into the case through the radiator, but as our case had no other exhaust fans, the inside became very warm. Reversing the fans to exhaust air instead saw only a small increase in the CPU temperature, but it was enough to lower the temperature inside the case.

The H70's cooling is excellent, and with its fans at low speed, it has the best noise-to-cooling ratio of any cooler in our Socket AM3 and LGA1366 test systems. However, it's much more expensive than high-end air coolers such as the Frio and the super-quiet Cogage Arrow. **AL**



Corsair A70

Corsair's first heatsink has got the goods.

Street Price \$100 Manufacturer www.corsair.com
Heatsink Material Copper heatpipe bas, aluminium fins

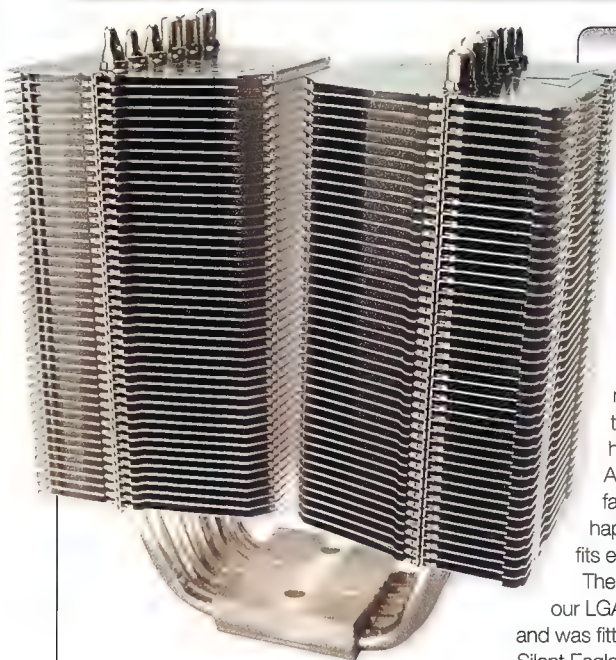
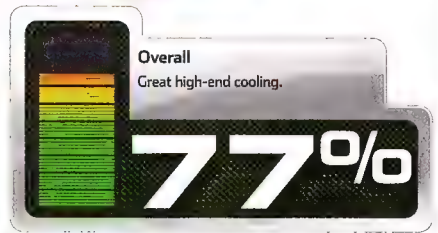
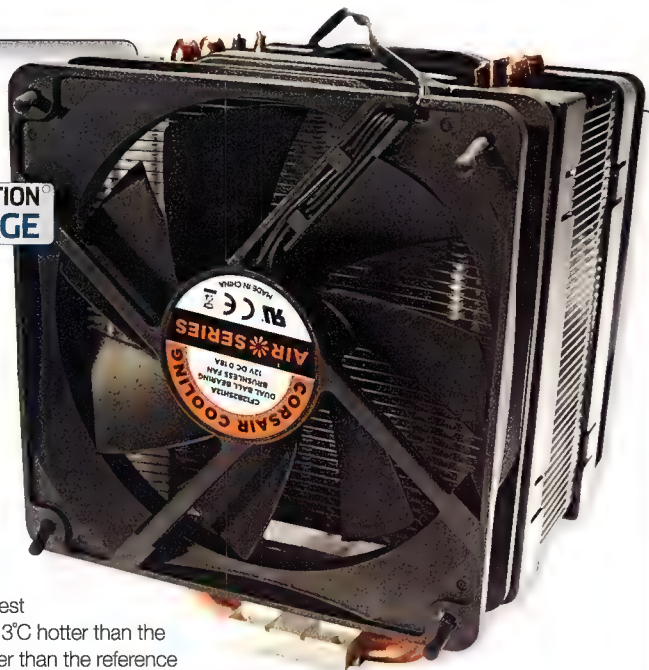


After diversifying into PSUs, water cooling and more recently cases, Corsair's latest endeavour is a range of air coolers. At the top of this range is the A70 – at \$100, this is one of the more expensive air coolers available.

The A70 is a beast of a cooler, with two 120mm shrouded fans sitting on either side of the heatsink in a push-pull configuration. Also included are a single two-way fan-splitter and two resistor cables that considerably reduce the speed and noise of the fans. While the fans were noisy at full speed, they were no more unpleasant than standard case fans. Installing the A70 wasn't anywhere near as arduous as the Cooler Master V6-GT either – in fact, it was fairly straightforward without too many fiddly components involved. Despite its size, it only obscured the first DIMM slot on our motherboards and even then, standard height sticks should fit underneath.

The A70 was never far from the top of the results table and in our Socket AM3 test system, and with its fans on full speed the CPU was just 5°C hotter than the best cooler, the Thermaltake Frio. It gave an awesome showing in the LGA1156 test system, with a delta T just 3°C hotter than the Frio and a huge 40°C cooler than the reference cooler. The A70 was also very good in our LGA1366 system, with only the Frio and Corsair H70 brushing the A70 aside, where it recorded a delta T 25°C lower than the reference cooler.

The A70 is a fantastic first effort and only a whisker short of the top spot in terms of cooling power, but we think it's just a touch too expensive. **AL**



Prolimatech Megahalems Rev.B

Mega cooling; micro value.



Street Price \$75 Manufacturer www.prolimatech.com
Heatsink Material Copper heatpipe bas, aluminium fins

array of fins surrounding six 8mm heatpipes. The heatpipes don't make direct with the CPU as with the above Corsair design – instead, heat is transferred via a contact plate. Although the mounting system is fairly elaborate, installation isn't too haphazard, and the finished assembly fits easily onto the motherboard.

The Megahalems is only compatible with our LGA1156 and LGA1366 motherboards, and was fitted with a pair of 120mm Sharkoon Silent Eagle 1000 fans for testing. In this configuration, it managed a delta T of 39°C in our LGA1156 test system – 37°C cooler than the reference cooler and just 6°C warmer than the Thermaltake Frio. However, the fans we used were very quiet, while the Frio had its fans at full speed. That said, the Frio still managed a slightly lower delta T with its fans set to their lowest speed setting.

In the LGA1366 test system, the Frio was 6°C cooler at full speed and slightly cooler than the Megahalems at low fan speed. Still, the latter's delta T of 53°C was 22°C cooler than the reference cooler, making it one of the better LGA1366 CPU coolers.

The Megahalems provides similar cooling power as other high-end coolers such as the Thermaltake Frio. However, as it effectively costs more than the Frio when considering fan purchases, it will be very expensive to get up and running. **AL**

The Prolimatech Megahalems is one of the more expensive coolers in the Head2Head, especially as it doesn't include any fans. This means that you'll end up spending at least another \$30 to populate the Megahalems' two 120mm fan mounts.

The heatsink comprises a fairly dense



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Copper PCB

Scythe Yasya

One to avoid in every situation imaginable.

Street Price \$70 **Manufacturer** www.scythe-eu.com
Heatsink Material Nickel-plated copper base, aluminium fins



Scythe's products have had a very chequered history, ranging from the quietly brilliant to the simply awful. We therefore approached the Yasya with trepidation.

The main problem with the Yasya is its installation process. At first impression it looks jagged and vicious; and unfortunately, this is exactly what it is. While installing it, a slight slip of the hand saw a copious amount of blood gushing all over the cooler, case and motherboard – not an experience we'd recommend.

Compared to the potato-peeler fins, the rest of the installation was a breeze. The heatsink mounts on either side of the contact plate install in a matter of seconds, a very fast result. Unfortunately, the Yasya uses the standard Intel push-pins to attach to the motherboard, which provide lacklustre mounting pressure and are notorious for being fragile, awkward and overall a terrible design choice.

A single 120mm fan cools the razor-sharp

heatsink and is equipped with a rheostat mounted on an expansion slot cover. Despite the seemingly decent design the Yasya isn't particularly effective as a CPU cooler. At high speed in our Socket AM3 test system, it managed a delta T of 35°C, warmer than the Thermaltake Frio, although, to its credit, slightly quieter. It didn't fare too badly in our LGA1156 test system, although it was 7°C warmer than the Frio, with a delta T of 41°C. Things fell apart in our LGA1366 test system, however, where it produced a delta T of 69°C – more than 20°C warmer than the Frio and barely cooler than the reference cooler.

Although dropping the fan speed doesn't have much of an effect on temperatures, the Yasya is a poor choice for a heavily overclocked processor, or even one at stock. While it may be a slightly better cooler compared to the reference



design, we'd still advise against buying it in the interests of self-preservation. Unless you've got a lot of potatoes to peel. **AL**

Overall

An overwhelmingly bad heatsink that isn't worth the asking price.

40%

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Thermalright IFX-14

A hard-to-find cooler for the LGA1366 socket.

Street Price \$115 **Manufacturer** www.thermalright.com
Heatsink Material Nickel-plated copper base, aluminium fins



The Thermalright IFX-14 appears to be a premium cooler for the price but unfortunately, like the Prolimatech Megahalems, it doesn't ship with any fans. As a result you're looking at spending at least another \$30 to fit it out properly with two good 120mm fans.

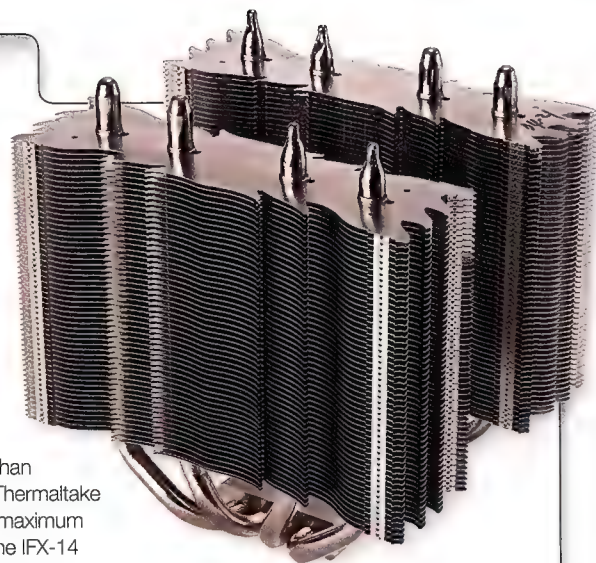
The IFX-14 looks almost identical to the Cogage, which isn't much of a surprise considering that Thermalright owns Cogage. It has two large arrays of fins, along with four 8mm heatpipes. The mounting mechanism is essentially the same too, although our IFX-14 only supported LGA1366 motherboards out of the box – to make it compatible with LGA1156 and Socket AM3 motherboards, you need to buy separate adaptors, which we were unable to obtain in time for testing.

Like the Arrow it wasn't difficult to install despite its enormous size. A single plate straddles the cooler and applies a firm mount with installation taking just a few minutes and not requiring the motherboard to be removed. This was a vast improvement over the terrible

Cooler Master V6-GT. As it doesn't ship with any fans, we used two 120mm Sharkoon Silent Eagle 1000 fans to fill each of the IFX-14's fan mounts.

The IFX-14 cooled our LGA1366 test system admirably, recording a delta T of 52°C, which is 23°C cooler than the reference cooler. In contrast, the Thermaltake Frio managed a delta T of 47°C at its maximum fan speed, and the same delta T as the IFX-14 with its fans at minimum speed so that both coolers were making a similar amount of noise. Curiously, the Cogage Arrow provided better cooling than the IFX-14, despite having a only single 120mm fan – clearly, there must be some small and important differences between the two coolers.

The IFX-14 is a capable cooler that costs the earth and is easy to mount. However, the Frio provides the same cooling power at the same noise level, with the option for more powerful cooling if you can handle a little more fan noise.



The Cogage Arrow was cheaper, even quieter, and it also includes a fan. **AL**

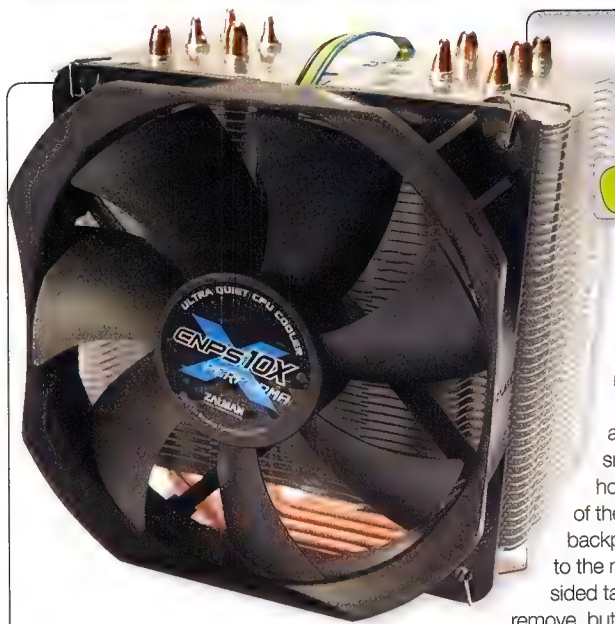


Zalman CNPS10X Performa

No, it's not missing an 'nce'.



Street Price \$46 **Manufacturer** www.zalman.com
Heatsink Material Nickel-plated copper base, aluminium fins



Zalman's CNPS10X Performa is one of the smaller coolers on test, although it isn't quite as tiny as 92mm fan-wielding heatsinks. It has five 6mm heatpipes and is equipped with a single 120mm fan that can spin up to a hefty 2000rpm. Even so, it proved to be quieter than many of the dual-fan coolers, such as the Thermaltake Frio. The fan supports PWM

and has an optional speed reduction cable.

Installation is fairly easy, if a little fiddly due to the use of small screws that pass through hold-down plates on either side of the heatsink, attaching it to a backplate. The backplate is fixed to the motherboard using double-sided tape; this can be very difficult to remove, but the alternative will be to ask a friend to help you – without the tape, you'll need at least three hands to mount the Performa.

Despite its small size, the CNPS10X Performa managed to keep up with the big boys in all three test rigs. It managed a delta T of 36°C in our Socket AM3 test system while the superior Thermaltake Frio stood at 28°C. It was 7°C hotter than the Frio in our LGA1156 test system with a delta T of 40°C, 36°C cooler than the reference

cooler. It managed a respectable delta T of 40°C in our LGA1366 test system too, which was just 7°C warmer than the Frio.

An important aspect of the CNPS10X Performa to consider is its price – at just \$48, it's only slightly more pricey than a couple of fans, while including everything you need. It's also \$30 cheaper than the Frio. As such, while it may not be able to compete with the big coolers, if you're building a smaller system on a tighter budget then it's well worth a look. **AL**





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Single Bay Docking Station on Top

Unique single bay HDD docking design

The Thermalright DOKKER is equipped with single bay docking station on top to provide you blazingly fast file transfer via the convenient hot-swap slot. Latest high-end graphics cards from ATI & NVIDIA® with a length of up to 12.5" (e.g. ATI 5970) are supported. For superior airflow and cooling efficiency, the Thermalright DOKKER provides room for up to 7 fans.

Thermaltake Frio

One of the most impressive heatsinks we've ever seen.

Street Price \$78 **Manufacturer** www.thermaltakeusa.com
Heatsink Material Nickel-plated copper base, aluminium fins



Thermaltake's launched their new dual-fan Frio CPU cooler a couple of months ago, and it's not hard to be blown away by its unique looks. Our expectations had initially been marred by previous coolers we'd seen from Thermaltake – the DuOrb (see www.atomicmpc.com.au/?133052) for example, left a lot to be desired. The Frio has faced some stiff competition recently, though, in the form of the Corsair A70 and other dual-fan coolers; but it trounces them all effortlessly.

The Frio has five 8mm heatpipes, whereas many other coolers, such as the Cogage Arrow and Corsair A70, have just four. Two variable-speed 120mm shrouded fans are included, and clip onto the sides of the large, dense heatsink fins. Unlike the Cooler Master V6-GT, the Frio isn't a pain to install, though neither is it the simplest. Bizarrely you need to secure it from the rear of the motherboard, with mounting screws on the opposite side threading into brackets attached to the Frio, which may necessitate the removal of your

motherboard to install the Frio.

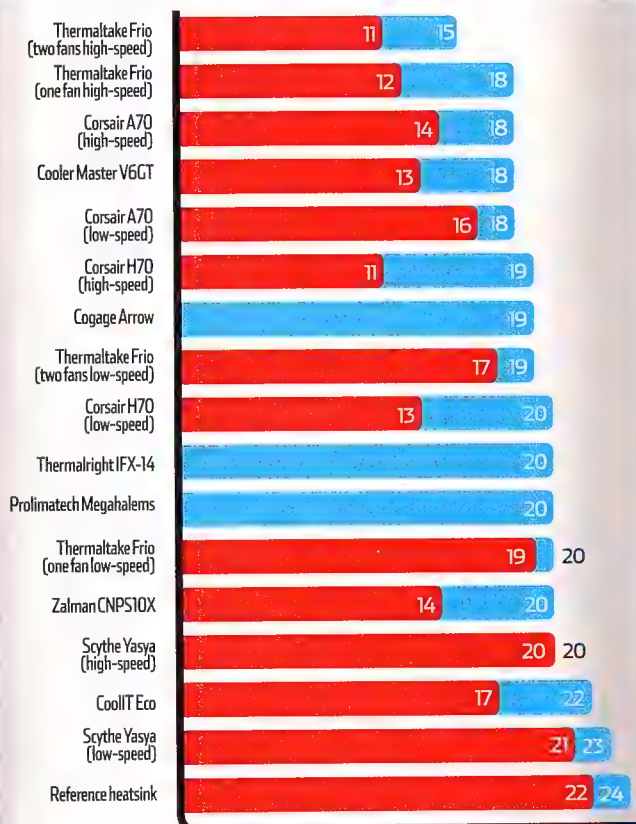
As Thermaltake specifies single as well as dual-fan operation, we tested it in both modes. With both fans spinning at maximum speed, the Frio came top of the Socket AM3 leaderboard with a delta T of 28°C. This delta T only rose to 32°C with both fans at low speed. With one fan at high speed, the delta T was only 2°C warmer, but 4°C hotter at low speed.

With its fans at maximum speed, the Frio outcooled all the other coolers in our LGA1156 test rig. However, the Corsair H70 drew equal with the Frio in our LGA1366 test system, with a superb delta T of 47°C.

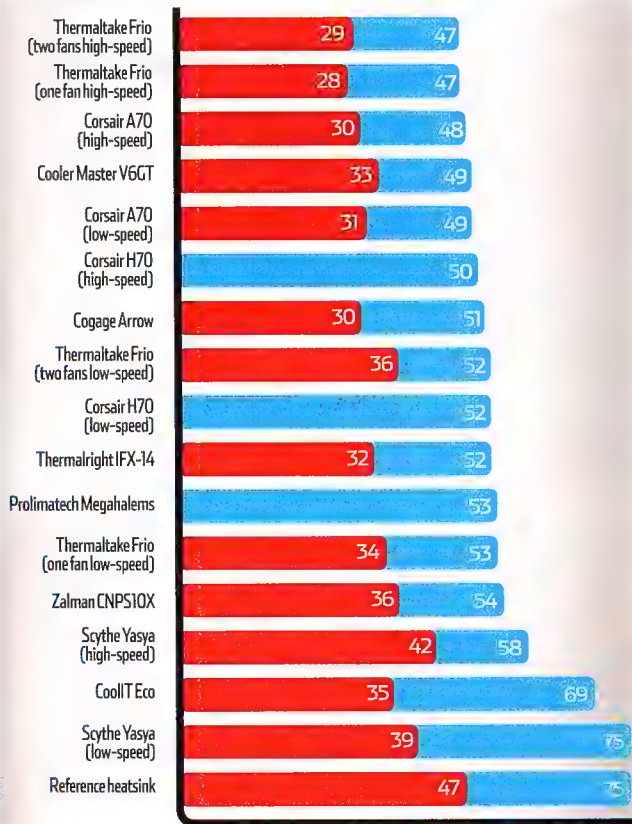
The Frio is noisy, especially at full speed, but as you can lower the fan speed to reduce the noise, we can easily recommend the Frio as the best heatsink of the bunch. **AL**



Idle delta T LGA1366/AM3



Load delta T LGA1366/AM3



LGA1366

Socket AM3

KITLOG

These are our four basic systems, with something for every taste. On this page, **The Game Box** is put together with money-saving in mind, but also an eye to getting as much bang for buck. It's the best value system for those who want a lot of processing grunt, but who don't want to sacrifice the upgradeability or compatibility that is so important. Intel's going to keep the P55 socket around for quite some time, so making the leap to this new platform is well-timed.

If you're going to spend money on a beast that generates pixels, you might as well spend a little more and get a screen that shows those pixels in their best light. This screen is that beast, and the 24 inches of colour-accurate screen boast a response time that will give you each sultry frame just as the game designer or movie director intended. Definitely a toy worth saving up for.

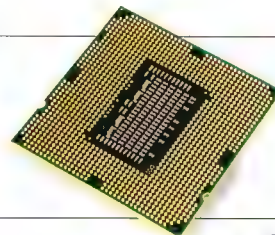


The Perfect PC, on the other hand, is the system everyone aspires to, with nothing but the best parts – without going crazy, though. It's a collection of all the greatest hardware that we'd pick without a budget, sure to impress with performance and sheer style.

Oh, and if you're wondering what the Ref IDs are, that's the ID of that article on our website. Just enter it like this – www.atomicmpc.com.au/?NUMBER – and you'll go straight to that review.

THE GAME BOX

CPU



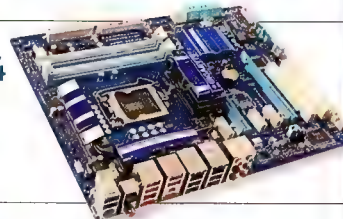
Intel Core i5 760
PRICE \$245

Intel's budget quad is more than you'll need in a chip – now even faster!

MOTHERBOARD

GIGABYTE P55A-UD4
PRICE \$225

A great value P55 board with some nice features.



MEMORY



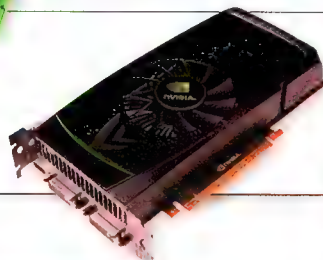
G.Skill Ripjaws F3-10666CL7D-4GBRH
PRICE \$130

Great value, tight timings, and some flexibility.

VIDEOCARD

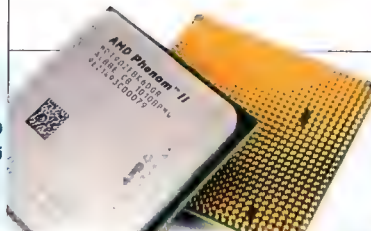
NVIDIA GTX460
PRICE \$245

A reference-design card, but plenty fast for gaming bliss.
Issue 116, Page 38



THE PERFECT PC

CPU



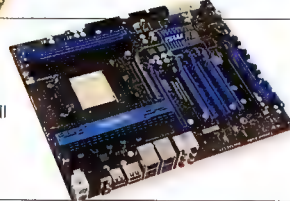
AMD Phenom II X6 1090T
PRICE \$355

Six cores of high-powered processing joy.
Ref ID: 220395

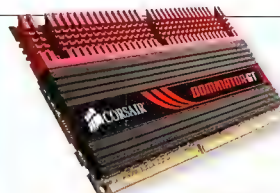
MOTHERBOARD

MSI 890FXA-GD70
PRICE \$265

A high-end AMD platform with full CrossFire support, great OC'er.
Ref ID: 221656



MEMORY



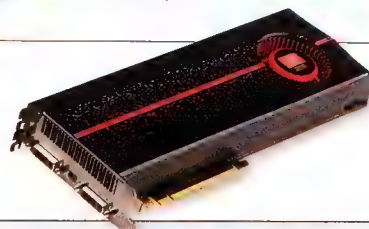
Corsair Dominator GT CMT4GX3M2A2000C8
PRICE \$220

Red-hot memory for dual-channel speed.

VIDEOCARD

ATI 5970
PRICE \$780

A dual-cored DX11 beast, the most powerful yet.
Ref ID: 173167



For more builds check out the Kitlog E-mag at atomicmpc.com.au/kitlog

SUBTOTAL: \$1660



Coolermaster Hyper 212

PRICE \$45

Nice cooling for a very affordable price.

CASE



Lancool Dragonlord PC-K62

PRICE \$165

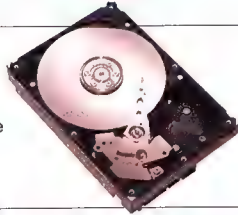
Vibration dampened, great cooling and sexy looks.

Ref ID: 160151

1TB HDD

PRICE \$90

A thousand gigabyte storage drive on the cheap.



KEYBOARD

Razer Arcosa

PRICE \$50

A cool-looking keyboard that'll serve you very well.

Ref ID: 149483



Viewsonic VX2233WM

PRICE \$215

21.5 inches of value-packed screen, great buy.

Issue 108, Page 42

MOUSE



Verbatim Rapier V1

PRICE \$65

Great gaming performance and nifty features.

Issue 96, Page 43

Plantronics Gamecom 777

PRICE \$80

Solid set of cans with great audio.

Issue 101, Page 41



Onboard Realtek ALC889A

A decent chip that does the job.

POWER SUPPLY

OCZ ModXStream Pro 600W

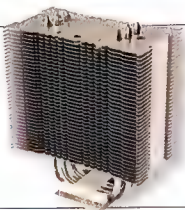
PRICE \$105

Plenty of wattage, reliable, modular for neatness.

Issue 109, Page 59



SUBTOTAL: \$4739



Noctua NH-U12P SE2

PRICE \$95

Two fans, quiet and nice overclocking capacity.

Issue 107, Page 48

CASE



Coolermaster ATCS 840

PRICE \$370

Heaps of fans, plenty of space, and dripping with quality.

Ref ID: 132479

OCZ Vertex 2 100GB & WD 600GB VelociRaptor

PRICE \$470 + \$400

Superfast SSD with zippy storage.

OCZ Ref ID: 219218

WD Ref ID: 220323



KEYBOARD

Microsoft Sidewinder X6

PRICE \$95

Backlit, sturdy, magnetic numpad & macro keys; what's not to like?

Ref ID: 129535



Dell U2410

PRICE \$699

In-Plane Switching, 1.07 billion colours and 24 inches.

MOUSE



Microsoft Sidewinder X8 Wireless

PRICE \$105

Cable-less, comfortable, lag-free and fraggable!

Ref ID: 148422

Logitech Z-5500D

PRICE \$400

Earth-shakingly good.

Ref ID: 22626



Creative X-Fi Titanium HD

PRICE \$270

Seriously serious sound.

Issue 115, Page 47



POWER SUPPLY

XF8 850W

PRICE \$215

Plenty of power, ultra-stable rails and a great price.

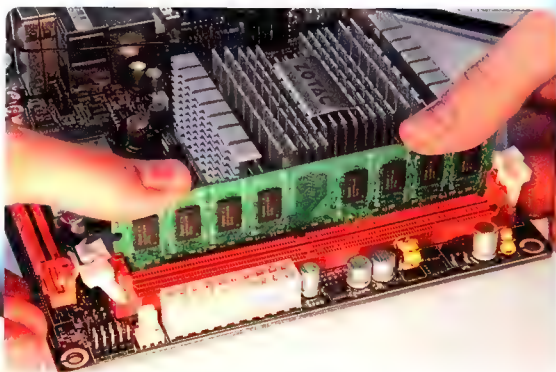
Issue 107, Page 50



The **LAN Rig**, the ultimate in portable gaming power – go anywhere, frag anyone. No longer will you be tied to a desk or forced to awkwardly manhandle your full-sized rig, helped by a convenient handle and beefy tech. Perfect for wowing people at LANs, the tech inside is fast enough to run any game, and boasts enough speed to keep your game running at full clip even if other programs intrude in the background. After all, no-one wants to miss a headshot.

There are many benefits to running an ITX system, aside from the challenge of choosing compatible components, but here are just a few of the plusses:

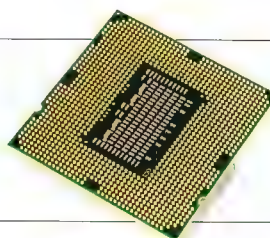
- Small footprint, so it'll fit damn near anywhere – even under a monitor.
- Lower power consumption due to restrained component choice.
- Generally low-noise due to the 'wind tunnel' design of most cases.
- Easily moveable around the house, or even taken to a mate's place – all you need is power and a screen.



Finally, for the more entertainment-minded – and really, that's all of us – there's **The Mini**, ready to play movies and music quietly and efficiently. The basic guts are fast enough for general tasks, and the IGP can handle High-Definition content. You can also choose from three entirely optional upgrades to suit your needs best: a graphics card for WoW, TV tuner to catch the game, or a Wireless card to sync without cables. The perfect energy-conscious build.

THE LAN RIG

CPU



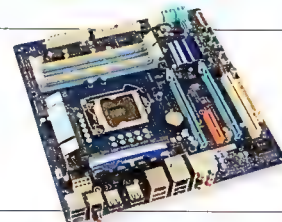
Intel Core i5 760
PRICE \$245

Intel's budget quad is more than you'll need in a chip!
Issue 106, Page 36

MOTHERBOARD

GIGABYTE P55M-UD4
PRICE \$200

Great overclockability, nice value.
Issue 107, Page 40



MEMORY



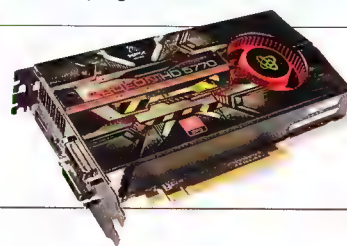
G.Skill Ripjaws 2000MHz
PRICE \$190

Great value memory with amazing overclocking.
Issue 106, Page 52

VIDEOCARD

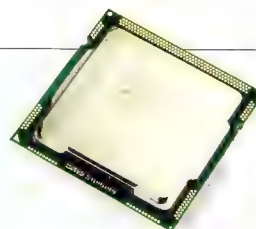
ATI 5770
PRICE \$190

A decent value way to get into DX11.
Ref ID: 169775



THE MINI

CPU



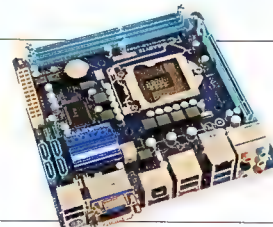
Intel Core i3 530
PRICE \$140

Speedy dual-core with an IGP for HD video duties.

MOTHERBOARD

GIGABYTE H55N-USB3
PRICE \$145

Tiny ITX form factor with up to 4 storage devices. Neat.
Issue 113, Page 39



MEMORY



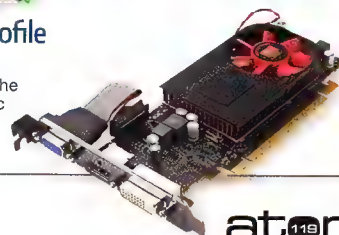
G.Skill Ripjaws F3-10666CL7D-4GBRH
PRICE \$130

4GB of fast memory is plenty for running multiple HTPC media streaming apps.

VIDEOCARD

ATI 5570 Low Profile
PRICE \$100

Graphical grunt in half the space. Enough for basic games, given the size.



For more builds check out the Kitlog E-mag at atomicmpc.com.au/kitlog

SUBTOTAL: \$1655

COOLER



Intel Stock Cooler

PRICE FREE

Does the job, fits under PSU well.

CASE



Silverstone SG04

PRICE \$160

Small case with handle; add two 120mm fans for awesome cooling.
Ref ID: 148266

SYSTEMDRIVE

1TB HDD

PRICE \$90

A thousand gigabyte storage drive on the cheap.



KEYBOARD

Razer Arctosa

PRICE \$50

A cool-looking keyboard that'll serve you very well.
Ref ID: 149483



DISPLAY

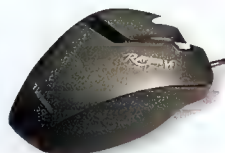


Viewsonic VX2233WM

PRICE \$215

21.5 inches of value-packed screen, great buy.
Issue 108, Page 42

MOUSE



Verbatim Rapier V1

PRICE \$65

Great gaming performance and nifty features.
Issue 96, Page 43

AUDIO

Plantronics Gamecom 777

PRICE \$80

Solid set of cans with great audio.
Issue 101, Page 41



Onboard Realtek ALC889A

A decent chip that does the job.

POWER SUPPLY

Corsair HX-520

PRICE \$140

Modular, efficient and keeps size manageable in cramped case.



SUBTOTAL: \$1033

COOLER

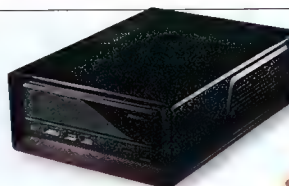


Scythe Big Shuriken

PRICE \$55

Tiny 58mm height, quieter than a sponge.

CASE



Antec ISK 300-150

PRICE \$110

Included 150W PSU, good build quality, and decent airflow.

SYSTEMDRIVE

WD Scorpio Blue 640GB

PRICE \$120

Fast 2.5" internal storage – grab two for more space!

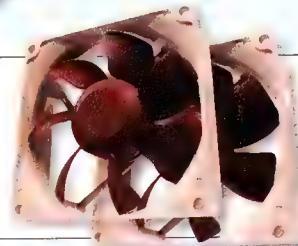


COOLING

Noctua NF-R8

PRICE \$22 x 2

Get some quiet, positive flow in this mini build.



OPTICAL



Lite-On DS-8A4S

PRICE \$70

Slim internal DVD drive for movies, installs or backups.

KEYBOARD



Logitech diNovo Edge

PRICE \$199

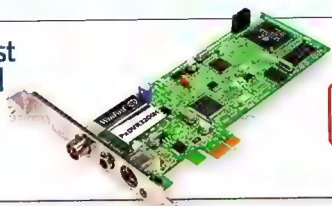
Wireless board with a trackpad for mousing.

TVTUNER

Leadtek Winfast PxDVR3200 H

PRICE \$100

Get TV in your PC. H.264 recording ftw!



WIRELESS

ASUS PCE-N13

PRICE \$45

Zippy 802.11n for wireless HD video streaming.





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Five trillion bits flying in loose formation

Daniel Rutter notices something odd about PCs...

I have a confession to make:

I have never had a PC that worked properly.

Sometimes I wonder whether anybody in the world has ever had a Windows PC that worked 100 per cent correctly.

I'm not talking about your great-uncle's Packard Bell with 31 toolbars crusting up Internet Explorer 5 and a thriving colony of spyware that sacrifices files to BonziBuddy five times a day.

I'm also not talking about PCs that belong to people who see no reason to turn the computer off while upgrading the video card.

I'm talking about every darn PC. Even the one next to Bill Gates' Throne of Misery.

card, any RF interference greater than that caused by a kitten walking across nylon carpet and then looking at a doorknob will cause any USB audio device to go silent until unplugged and replugged. Or – in the case of one very fancy audiophile USB headphone amplifier I've tried – explode into a storm of deafening noise, I think caused by bit-slippage giving the most-significant-bit's job to another, less significant and much less responsible, bit.

(I've gone back to the integrated audio. It works fine. But it was better before I updated the drivers in an attempt to cure the Not Responding Problem.)

I've always had white-box clone PCs, running whatever version of Windows was

those things are actually the fault of third-party hardware, drivers and apps that only work at all because of the shimming efforts of long-suffering Microsoft coders, but the suckage remains.

(I can feel the smugness radiating from you Mac users. Apple has a death-grip on their hardware and a smaller application base, and the result is a much smoother ride for Mac OS users, provided they don't start using the Terminal when drunk. And Linux covers the whole spectrum, from shake-and-bake LiveCDs to good old compile-it-yourself traditionalism.)

Soon, in the sweet bye and bye future, everybody will have a computer that Just Bloody Works, all the time.

While I'm waiting, I've decided to think about Macs as Toyota Camrys, and Windows PCs as English sports cars. ☹

My current computer's generally great. But whenever you reboot it, it POST beeps, then reboots itself and POST beeps again...

My current computer's generally great. But whenever you reboot it, it POST beeps, then reboots itself and POST beeps again, and then one more time for luck. Then, it goes on to boot perfectly normally.

I presume this has something to do with the motherboard's backup-BIOS feature. It's possible I could cure it with a BIOS update. I hardly ever reboot the computer, though, so I don't really care.

I do really care about this computer's dose of what may by now be officially called The Windows 7 'Not Responding' Problem, which I will probably have cured by the time you read this. Or may not, since the problem seems to get angry whenever I look at it too closely. It doesn't mind me playing games, though, so we have, for now, reached an uneasy détente.

Oh, and don't you try plugging a USB audio device into this computer! Whether connected to the built-in USB ports or the add-on USB

least dangerous to itself and others at the time. I can't remember *one* of the buggers that worked entirely right. They all worked well *enough*; only a couple have ever had ongoing problems that really annoyed me. Which is a pretty good record when compared with, say, cars. But still.

Brand-name PCs generally have less personality than clones, because their Windows install and apps are (meant to be...) tailored precisely to their hardware. And they usually remain like this, provided you make sure to never install anything at all. And avoid using the computer unless it's an emergency. Until that awesome brand-name hardware starts flaking out, of course.

The obvious conclusion to draw from this is that Windows sucks.

This conclusion is partially correct. There are many things about Windows PCs that definitely do meet the ISO standard for suckage. A lot of

Dan Rutter often takes his PC for a spin.

dan@atomicmpc.com.au



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Web: www.mmt.com.au

TUTORIAL

HANDS-ON TUTORIALS FOR THE TECHNICALLY MINDED

Curiosity. It's killed many a cat, and probably more computers than you can poke a stick at. As geeks, and in fact, as humans, we are impossibly inflicted with curiosity. We're dying to know what that big red button does, or what we'll see if we click on that suspicious-looking link – even when we're pretty sure it won't be pretty.

Which is why virtual home servers can be a gift from the gods – protecting all our data from almost-certain destruction. This month, we take you

through the process of setting one up – for pretty much nada.

And if that's not enough learning for you, then maybe you need more. Maybe you need to go somewhere where there is literally no such thing as too much learning. Yes, that's right: graduate school. This month Chris Taylor takes you by the hand and leads you down the hallowed halls of higher, higher, higher education. From graduate diplomas, all the way to doctorates (eep!), he's taking you back to school with a flourish.



TUTORIAL CONTENTS

Atomic.edu 74
Chris Taylor on how to get your post-graduate learning on.

Tutorial 76
INSTALLING A VIRTUAL SERVER
Chris Trowbridge walks you through the process of building your happy place.

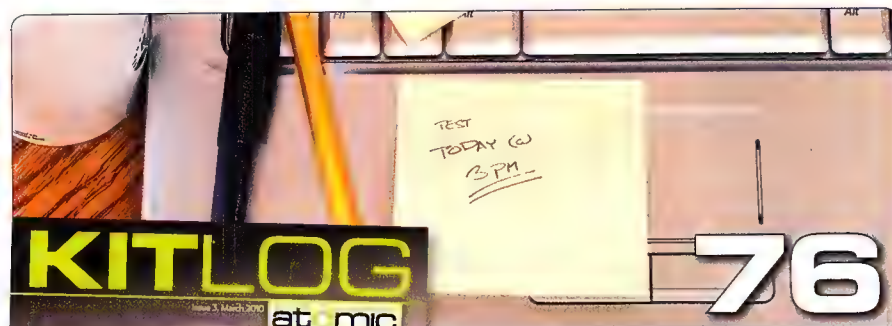
atomic
MAXIMUM POWER COMPUTING

WEEKLY NEWSLETTER

Keep up with the latest from Atomic!

Atomic isn't restricted to the pages of this magazine, and there's still plenty more to be had online. Make sure you grab the latest content, competitions and posts straight from your favourite mag by signing up for the weekly newsletter – it's what we would do!

www.atomicmpc.com.au/signup



The essential guide to building and cooling your next computer.

Do you like building systems?

Are you keen to always know the best hardware for any PC build or rig? Then you need to check out our new KitLog eBook, a quarterly online publication dedicated to showing you the best gear for more than a half-dozen PC projects.

Only available at
www.atomicmpc.com.au/kitlog

Beyond the Bachelor



Chris Taylor looks at life beyond a standard degree.

For some, a three- or four-year Bachelor's degree is quite enough university, thank you. It's given them a large enough HECS debt; it's provided them with enough skills to find some entry-level job. Especially if you've cruised through your degree comforted by the fact that "Ps earn degrees", the idea of more university – years of it – is probably abhorrent in the extreme.

Still, there are a host of reasons why you might want to stick around for a few more years. It may just be that life is good when you've got Centrelink payments coming in fortnightly and a cheap pub full of pretty ladies (or men) five minutes from the IT building. And maybe you like learning in the university environment. Or, more practically, it could be that what you want to do requires more than a Bachelor degree.

Post-graduate

So what lies beyond a Bachelor degree? First of all, there is the option of doing Honours. Honours is, essentially, an extension of your undergraduate degree. If you perform well enough academically you'll be offered (or be eligible for) the opportunity of completing another year's worth of study. Successfully complete that extra year and you'll walk out of university with a Bachelor of Whatever (Hons). Exactly what's required of Honours students varies from faculty to faculty, university to university. In some instances you'll need to have a very good academic record and be prepared to endure a very stressful extra year. In other instances you'll only need a vaguely respectable academic record – maybe a credit average – and enough commitment to knock over eight more electives.

And then you have Master's degrees. A Master's degree is not an extension of a Bachelor's degree. It is a degree in its own right, although you need to have completed a Bachelor beforehand. Complete a Master's after your Bachelor and you get a separate sheet of paper to frame and pin on your wall to show everyone what a fine professional student you are/were. Master's degrees come in a couple of forms. There are those that, like an Honour's degree, will lead you into a PhD or Doctorate programme. These involve working on research projects smaller in scale than those completed by PhD and Doctorate students. There are also more practical Master's degrees. In such a degree you may be focusing on a specific area of the broad spectrum of material covered in the preceding Bachelor degree. They are completed by coursework as opposed to research – subjects in the traditional sense as opposed to

an independently conceived and realised project. In some instances, a completely different faculty may offer the Master's degree. With a Bachelor of IT or similar, it's possible to enter some Master's programmes offered by some universities in faculties such as commerce, education and engineering. Generally, Master's degrees attained by coursework will not grant you entry into a Doctorate or PhD programme.

The Graduate Certificate and Diploma, like the Master's degree, require you to have first completed a Bachelor's degree (not necessarily in the same faculty) and will see you walk out of university with a separate sheet of paper. Generally they don't get you into a Doctorate or PhD programme but there are exceptions. Some universities offer one year Certificates that involve mini-research projects and serve to 'convert' undergraduate and postgraduate qualifications earned through coursework, so that you are eligible to enter higher research programmes. Graduate Certificates and Diplomas are typically shorter than Master's degrees. Most are one year long if studied full-time.

Finally you have the Doctorate. To enter a Doctorate you generally need to have completed a Master's by research or an undergraduate degree with a year's worth of Honours studies tacked on. You may also – and this applies to some Master's degrees, too – need to have spent a few years in the real world actually doing whatever it is your undergraduate degree qualified you to do.

The type of Doctorate you're most likely to be familiar with is the PhD or 'Doctor of Philosophy'. The PhD is a research degree. PhDs are long-term commitments. When applying to the university you need to provide a summary of what you want to do and, perhaps, nominate someone within the university who'll supervise your efforts. The only 'coursework' may be an introduction to research ethics and

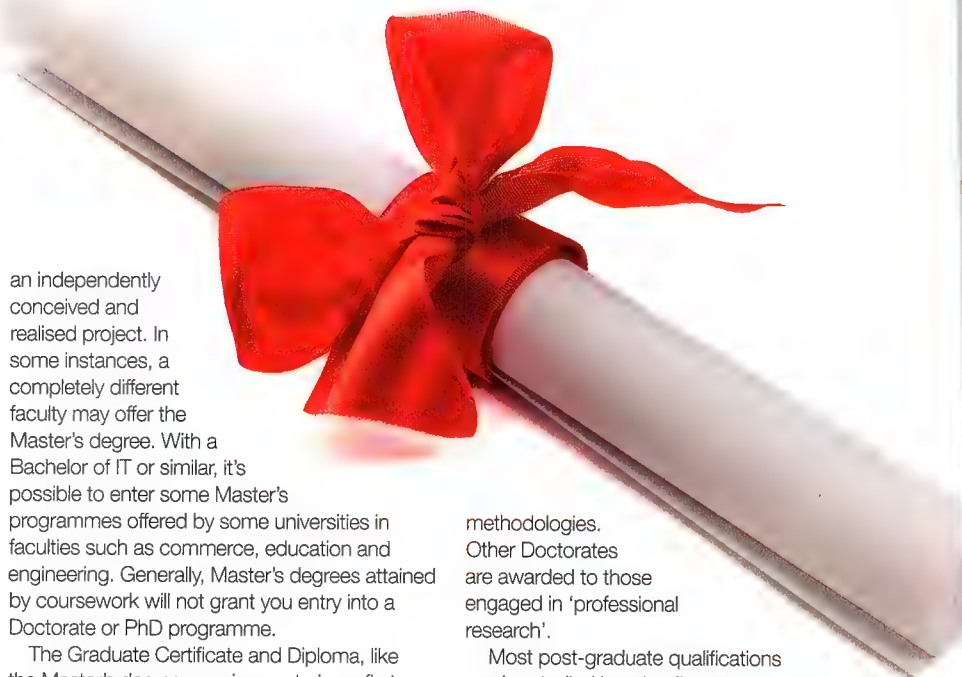
methodologies.

Other Doctorates are awarded to those engaged in 'professional research'.

Most post-graduate qualifications can be studied largely off-campus or part-time as they are designed with working people in mind. Depending on your profession and your course, it is possible to balance post-graduate study and full-time employment.

Post-graduate to build upon existing knowledge

A post-graduate qualification can simply extend upon your Bachelor's degree, providing you with an extra year or two or three's worth of theoretical knowledge you can slap on your resume and show off at job interviews. Typically, though, Master's degrees are very specialised. If you're interested in some specific aspect of IT, for example, you might undertake a pretty general Bachelor of IT or Computer Science and then follow it up with a Master's in something much more specialised. In recent years, seemingly, undergraduate degrees in IT have become more generalised. Whereas in the early and mid 2000s a lot of degrees were on offer, now universities only offer two or three degrees with a whole lot of core subjects common between all majors. There are a few good reasons for this shift but it means the degrees are less specialised. Post-graduate study in your area of interest may be necessary depending on what you want to do.

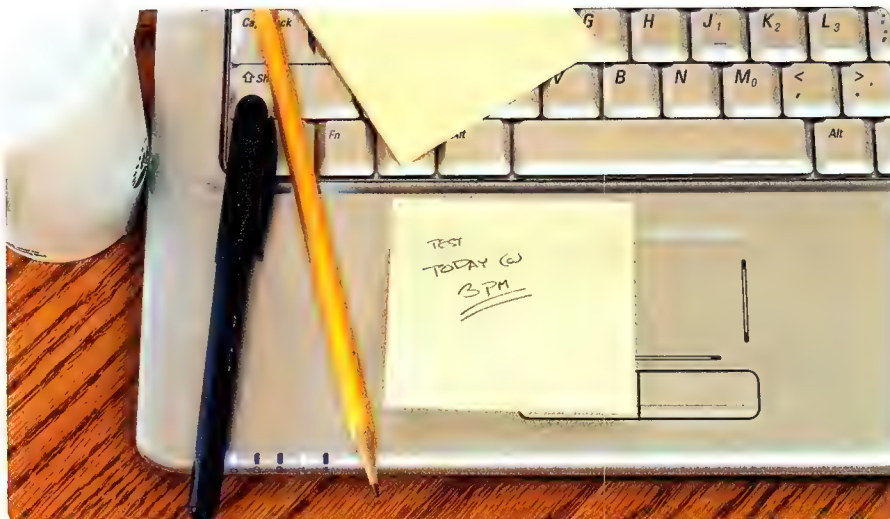


Post-graduate to shift professions

If you're bored of your chosen field after three or four years of study – it happens – or want to work in something a bit different, it's possible to use a post-graduate qualification to shift between industries. Some universities, such as the University of Melbourne, offer Master's degrees that you can get into after studying pretty much anything. Similarly, some Graduate Certificates and Diplomas demand no more than a Bachelor's degree and a record that suggests you showed up enough and understood enough to write coherent assignments.

Different universities have different offerings, but it's possible to find these post-graduate qualifications – which generally won't get you into a Doctorate programme – in faculties such as arts, commerce, education, engineering, law and science. As an example, with a Bachelor of Computer Science and a Diploma or Master's degree in secondary education, it's possible – if you really want – to become a secondary school IT teacher.

These degrees need not be completed immediately after you finish your undergraduate qualification. You might have spent a few years in an industry before you decide you'd like to swap to something else. Or perhaps you want to stay in that same industry to advance

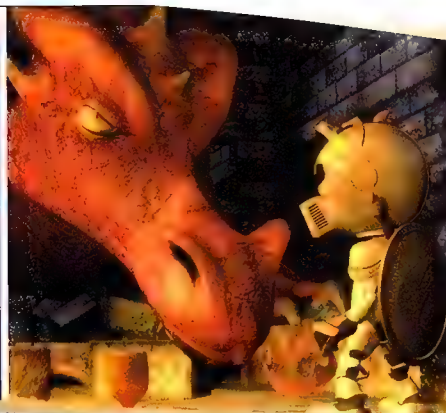


further so you're eyeing off a Master's-level qualification in management or marketing or something similar.

Despite being offered by different faculties, these Master's degrees may be shortened in your personal case due to prior studies. If you've already knocked over a computing degree, you can probably argue your way out of the obligatory unit or two of IT stuff. In some instances, depending on your prior studies, you may be able to trim an entire year off a two or three year Master's programme.

Overall

While a few employers demand postgraduate qualifications and a lot like them (in addition to hands-on experience, of course) it's critical to realise that a Graduate Diploma or Master's of Whatever doesn't mean you can skip working in an entry-level job. Unless you have a very lucky break or very unique set of skills, you'll still be starting at the bottom, although you may be paid a bit more and find advancement easier (assuming you apply yourself).



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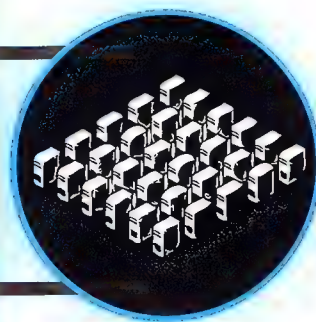
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Creating Your Happy Place



Installing a Virtual Server

Want a safe, secure, virtual computing environment to play around with? **Chris Trowbridge** has your answer.

It is 3am and the coffee is no longer working. Your head hurts and your eyes are glazed from five hours of installing and tweaking, but you have that familiar tingly sensation in your bits as The beast (or your iteration of it) is finally built. You're about to pack it in and dream of pwn'ing n00bs with the new rig when you get a tantalising email inviting you to a strange website. Could be a trick, or perhaps you can finally view those elusive rainbow unicorns...

Don't you wish you had a safe, separate place to experiment?

Meet VMware's ESX Server, a hypervisor that creates an environment in which you can create as many Virtual Machines (VMs) as you need. These machines can all run concurrently within a single physical machine and can be started, stopped, and paused independently of each other. VMs can run any operating system and are normally not even aware that they're not running on dedicated hardware. Virtual Machines can even be moved from server to server while running, and without interruption!

This amazing technology is now used everywhere in large datacenters to create highly redundant and manageable server farms. So when you buy a heavy duty chunk of IT iron, your needs change from the number of servers required, to required server capacity. This is all

wonderful and almost a little magic, but also very expensive for the licensing and hardware required. Or is it?

The good folks at VMware have created a smaller brother for ESX called ESXi, which they let you licence and run for free. It has all the stability and reliability of its larger sibling, but the free licence effectively turns off the fancy High Availability failover tricks you may require in a business environment. Even better, ESXi can run on common desktop hardware (like the PC you recently buried in the corner because it wouldn't run Bad Company 2 fast enough to compete!).

Once you've created your ESXi Virtual Happy Place you can easily create Virtual Machines (VMs) as you need them. These VMs are functionally identical to real hardware,

complete with their own BIOS. Install them as Windows, Linux or whatever you need to test that potentially life-changing program, and then delete or rollback when you're finished. Finally, a safe 'sandpit' in which to experiment!

So how do you go about it?

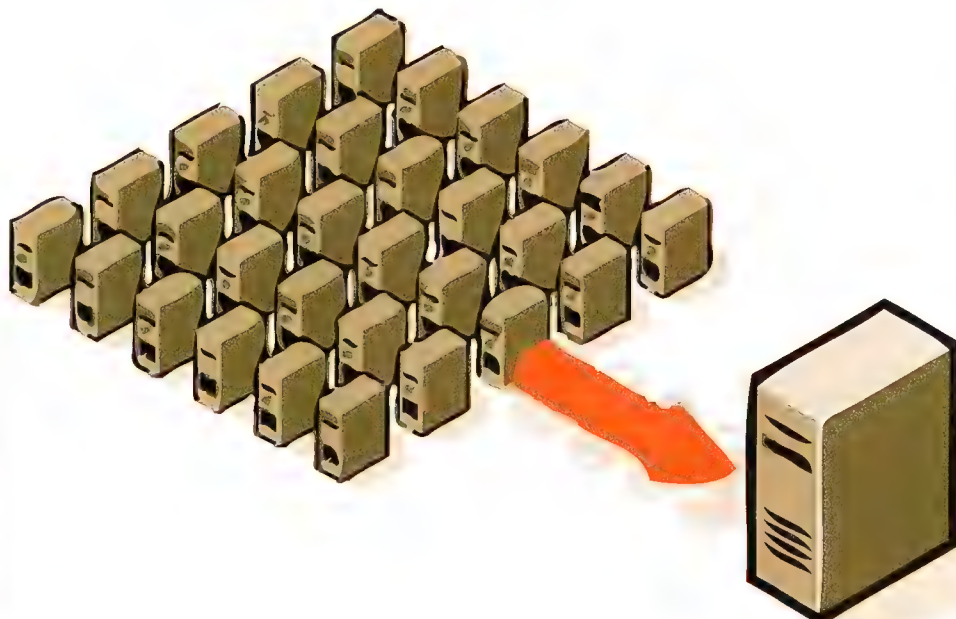
Planning Your Hardware

First you should plan out the hardware. ESXi is designed as a 'headless' server, meaning once installed it is happy to sit in the corner or cupboard while you manage it via a remote Windows console application. Consequently graphics performance is irrelevant, but CPU horsepower, RAM and hard disk space are the keys to good ESXi performance.

At this point I would like to introduce you two

ESX and ESXi merge

VMware has announced plans to merge ESX into ESXi and retire ESX. In the future you will be able to run the exact industrial strength product, albeit with some limited features, for free!



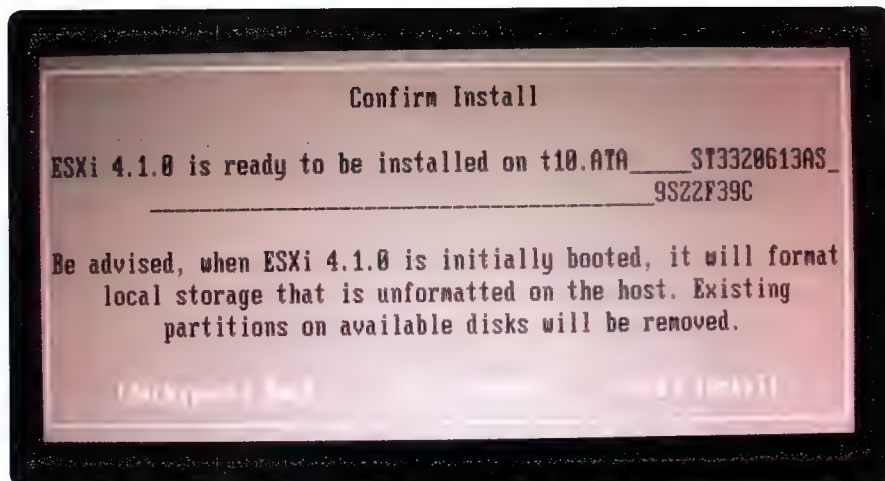


Figure 1. Read and confirm, people! Confirm the install and ten minutes later a happy place is born!

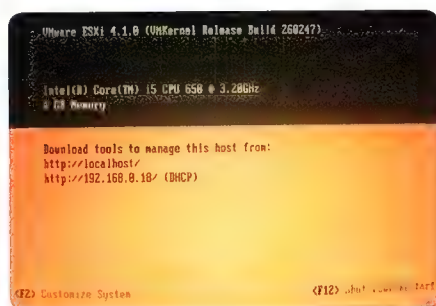


Figure 2: The ESXi console, basic but useful.

new Best Friends. Firstly, the official VMware support site www.vmware.com/support. This site is your 'official' best friend and provides various guides to get you started. You will note that this is more oriented at server hardware, which is ESXi's primary focus. So, you should also meet your 'unofficial' best friend at www.vm-help.com. This site is maintained by the VMware community and details not only common desktop hardware tested and verified to work, but also tips and tricks on how to get the most out of your server once it is up and running. This site was most valuable to me when building my first Happy Place.

Motherboard

ESXi works well on many common desktop mobos, and you should consult your Best Friends to check yours out. You don't need an expensive board; a no-frills model just fine. I'm running an ASUS P5KPL-CM uATX board for well under \$100; though I now wish I bought an mATX one with more RAM slots!

Network card

Your next priority is to verify that your onboard network card is supported, or ESXi won't install at all. If the onboard chip isn't supported all is not lost; a simple Intel EtherExpress card for \$40 will cure all your ills and is well supported in ESXi.

CPU

Next check out your CPU to ensure it has the relevant features for virtual hosting. Visit Intel

or AMD's website to find the specs on your particular chip (including SPEC info) and check for the following features:

The chip **must be 64-bit capable**. ESXi 4 is only 64-bit. Simple. If you only have 32-bit hardware available and are desperate to get going you can try ESXi 3.5, which is also available for download on the same page. It is similar to ESXi 4 although it may be missing

some features.

Secondly, **look for Intel Virtualisation Technology (VT-x)**, sometimes also known as Vanderpool Technology. The AMD equivalent is known as AMD-V. This feature provides hardware support directly aimed at products like ESXi. It's not absolutely essential to have in your chip, but it will really help ESXi to optimise performance. If you plan to host 64-bit OSes you will definitely need this feature, otherwise only 32-bits for you!

Thirdly, **check for Intel Virtualisation Technology for Directed I/O (VT-d)**, or AMD's AMD-Vi. This is the new kid on the virtualisation block and is currently only found in the more expensive CPUs. This feature extends VT-x to allow the virtualisation of I/O devices, allowing ESXi to give your VM a dedicated onboard device or PCI card. VT-d is a very handy feature for some, but not essential for most.

Note that features like Intel Speedstep (CPU throttling), Hyperthreading (HT) and multiple cores all of which are recognised and utilised by ESXi.

Your CPU is the place to invest your cash if you are building/upgrading a machine up for ESXi. Some cost effective choices are possible however. For example, some E7500 chips are VT-x enabled – you can find others if you examine the SPEC codes carefully!

... graphics performance is irrelevant, but CPU horsepower, RAM and hard disk space are the keys to good ESXi performance.

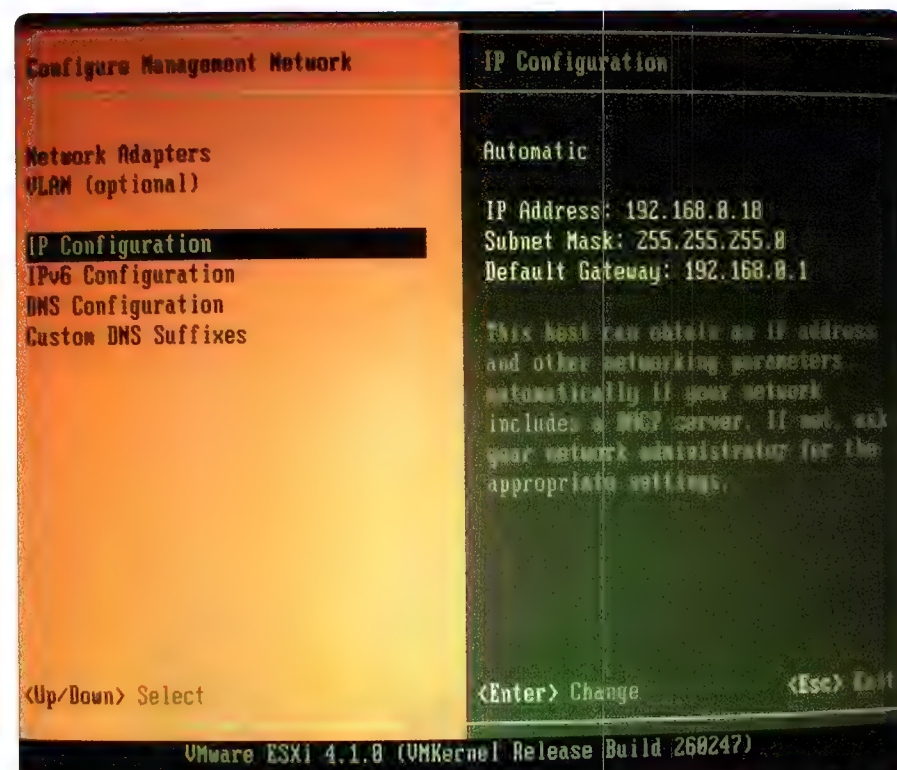


Figure 3: Hardcoding an IP for your server.



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THE EVOLUTION OF AUTHORITY



Figure 4: Enabling command line access, both console and remote.

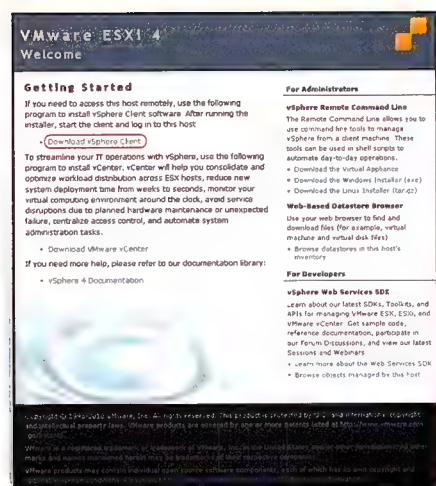


Figure 5: ESXi's Homepage.

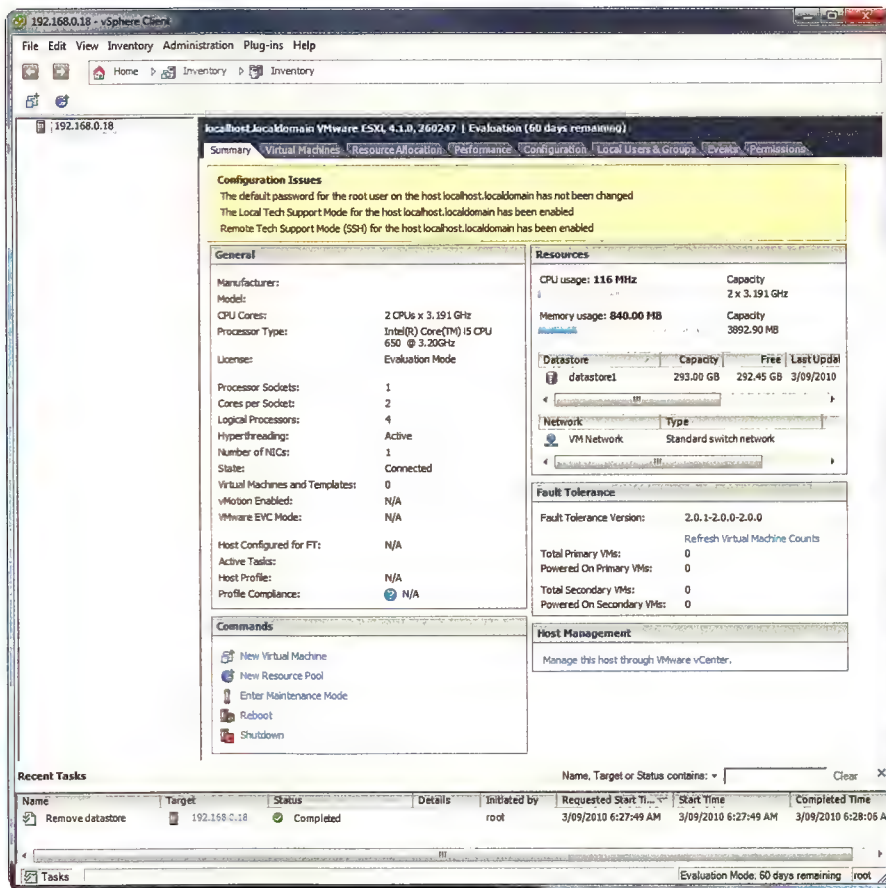


Figure 6: Welcome to the vSphere client, ESXi's management application.

If you only have one disk don't fret, ESXi will still install and run without issue. You will just have to store your VMs on your system disk.

RAM

RAM is plentiful, cheap, and generally easy to install. If you are resurrecting your banished BC2 machine perhaps consider boosting the RAM to 4GB or so; this is usually dictated by the number of slots on your board. You can start with whatever the machine currently has, but factor in that ESXi has an overhead of around 512MB to be comfortable. That being said, you will find that Windows will run in surprisingly little memory once you actively monitor it with ESXi.

Hard Disks

Your choice of hard disk will also determine your final ESXi performance. If at all possible you should plan to run two hard disks. The first will be your ESXi system disk. It doesn't matter if this is tiny and relatively slow as once ESXi is booted the real work is done by the second disk, so your trusty old 80GB will do fine here.

The second disk is where your virtual machines are stored and as this is the workhorse once things get busy the larger and faster the better. Any SATA disk will do, but features like SATA-2, NCQ etc will all be used to their full

potential if available.

If you only have one disk don't fret: ESXi will still install and run without issue. You will just have to store your VMs on your system disk. If this is the case you may find that you run out of space for your VMs fairly quickly. Remember that ESXi uses the physical hard disk serial number in the VM config files. So if your VMs are on a second drive and a Bad Thing occurs causing you to reinstall ESXi on the first, they

all magically reappear in their datastore and recovering is simple.

CD

Finally, fit a standard CD/DVD drive. Even an old IDE drive is fine so long as it can read a standard burnt disc. This drive will not only be where you install your ESXi hypervisor from, but can also be later mapped into a running VM as required.

Obtaining ESXi

ESXi is a free download from www.VMware.com. To download it, create an account on the website, log in and navigate to the VMware vSphere Hypervisor download page. Save the licence key displayed here as it is unique to your account, and then select the ESXi Installable

Get a Head Start

Why not create your first VM to play with? Right click on the Server IP in vSphere and start the 'New Virtual Machine' wizard? You should have Windows up and running in no time. You may even have a spare licence sticker on the side of your ESXi box. Yes, you do need a valid Windows licence for each VM.

If you're wondering what to do with the Windows CD at this point, right click on your newly created VM and choose 'Edit Settings'. Select your 'virtual CD' and you'll see you can select to connect it to either the host's (ESXi's) CD, an ISO image of a CD, or even a CD drive on the machine vSphere is running on! Just remember to check the boxes up the top to connect it at boot time.

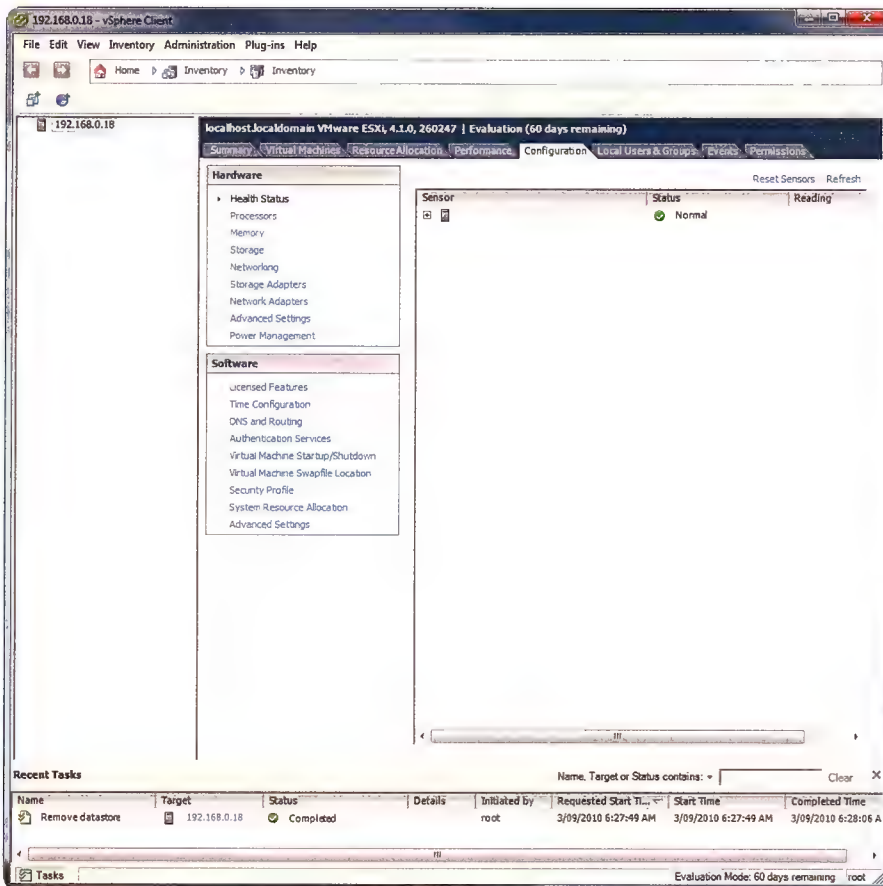


Figure 7: The vSphere configuration tab.

ISO image. Now sit back and relax as 300MB of goodness flows your way...

Installing ESXi 101

Installing ESXi is very simple and takes less than 15 minutes. Boot up from your freshly burnt CD and choose to 'Install ESXi'. You will be asked to accept the EULA and on which disk you would like to install. Select your system disk from the list and note carefully the warning as shown in Figure 1. When ESXi boots for the first time it may format all disks on the system so be aware. (If you are recovering from A Bad Thing and your VMs are on a second disk you may wish to shut down and unplug your secondary VM disk to be sure they remain intact).

Once you reboot into ESXi you will see a text-based console similar to Figure 2.

You should immediately press F2 to 'Customise Server'. It will prompt you to log in and the default username is 'root' with a blank password. First up you'll want to 'Configure your Management Network' and hardcode a static IP address into the server; see Figure 3. (You'd hate for your happy place to wander off on it's own somewhere, wouldn't you?)

Next, select Troubleshooting Options in the menu. In this screen you want to enable both the 'Local Tech Support', and the 'Remote Tech Support (SSH)', as in Figure 4. This will allow you to manage your server through the command line if desperate and also to configure some of

the more advanced features.

This is all you will have to do using the keyboard and screen of the server itself. You may wish to shut the machine down, remove the screen and

Advanced Features

ESXi is a large and complex hypervisor and as you explore the vSphere management tool you will see just how configurable it is. For more information on the advanced features available, consult your Best Friends on the web for full documentation and other tips.

keyboard, and power up under the desk out of the way. All it needs is power and a network connection from this point on to function.

Now, point your web browser at the server's IP address, accept the security exception (due to the self-signed SSL certificate), and you'll see the default ESXi page as in Figure 5. The most important link on this page is the first, to download the vSphere Client. Click and install on your PC, as it is your main administration tool.

The vSphere (Management) Client

The vSphere client is the GUI tool to manage all aspects of your server. Start the client and log in to your ESXi server. Once again the default username is root with a blank password. You'll see a reminder to 'apply the licence key' and then a display similar to Figure 6.

On the left hand side you will see your server's IP address. This area lists your server and the VMs you create in a typical tree form. You can click to select the server or any of its VMs to manage them.

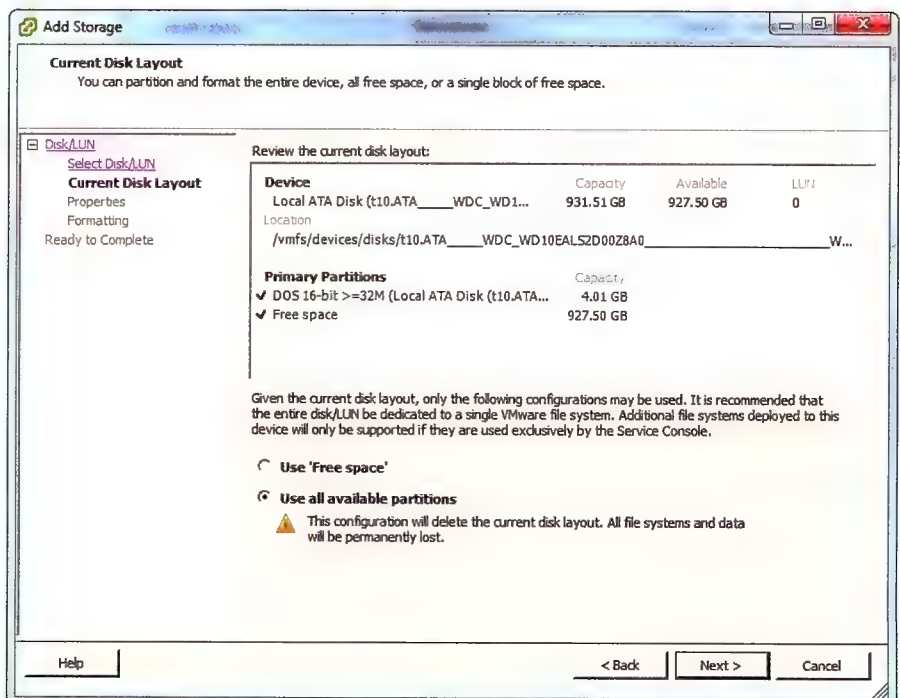


Figure 8: Wiping old partitions when adding hard disks.

Across the top of the screen you will see various tabs. These tabs allow you to adjust or examine the various aspects of the selected server or VM. They are context sensitive, so some tabs only appear when a VM is selected, or the ESXi host.

The 'Performance' tab is available for both host and individual VM. This is particularly useful to obtain performance graphs on usage of CPU, memory and disk transfer speed amongst others. Use this tab to determine where your resource bottlenecks are and if something is not functioning.

The 'Events' tab lists any significant events for the ESXi environment, including recommendations or errors. Everything is logged here, noting the VM that logged it.

Moving In...

Let's begin by formatting the second disk in this machine as a datastore in which our VMs will reside. Select the server IP and then the Configuration tab. You should see a similar display to Figure 7.

You can adjust various aspects of your server via the 'Hardware' and 'Software' boxes in the middle of the screen. This is where all ESXi configuration is performed, as well as monitoring the health of hardware etc.

Now select 'Storage' in the Hardware box. You will see a view of the default datastore called datastore1. This resides on your system disk and is where you can store your VMs if you only have one disk in the machine. In this example I have a second disk and so I can choose the 'Add Storage...' hyperlink at the top of this box. Here you have two options and I want to select 'Disk/LUN' to create a datastore on a locally attached disk. Next ESXi displays all unused disks in the system which makes it all pretty simple if you only have one! Click to highlight and click 'Next'. If you have previous partitions on the disk you may see something similar to Figure 8. You will almost always want to wipe these for exclusive use by ESXi, as I have selected. You will then have to enter a name to call your new datastore. I suggest "Virtual Machines" for clarity. Finally accept the default Maximum file size (unless you're going to create virtual hard disks

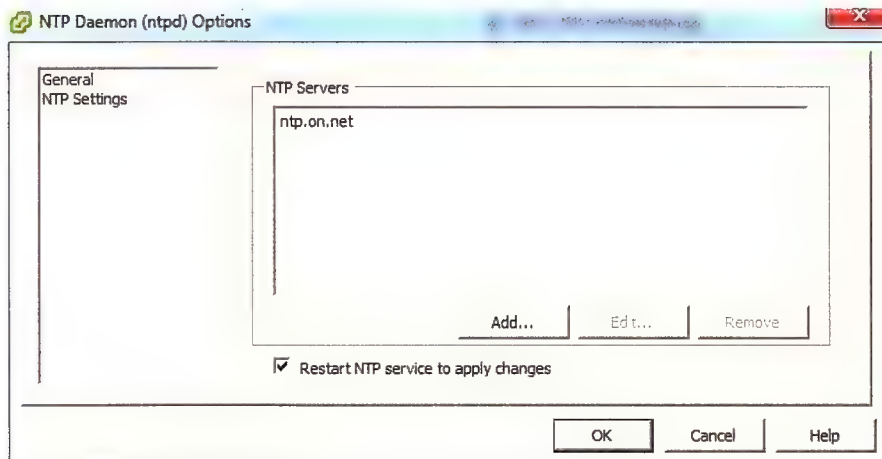


Figure 9: Setting an NTP server in the vSphere client.

over 256GB!) and complete the wizard.

Once done you can switch back to the 'Summary' tab and see your VMs' datastore appearing in the list. You can right click on Virtual Machines to browse the datastore similar to a folder structure. The icons at the top of the window provide your basic transfer functions. I suggest creating a folder called ISOs to store your DVD install images at this point.

It's useful to ensure your server's time stays

take effect.

Finally you should note that 'Licenced Features' is where you select to enter your saved licence key to licence your server. This action disables the various advanced (expensive) ESXi features so you may want to 'evaluate' for a bit longer before typing in the key from the VMware website.

Congratulations, you are now the proud owner of your very first ESXi box! Don't be afraid to look

Once done you can switch back to the 'Summary' tab and see your VMs' datastore appearing in the list.

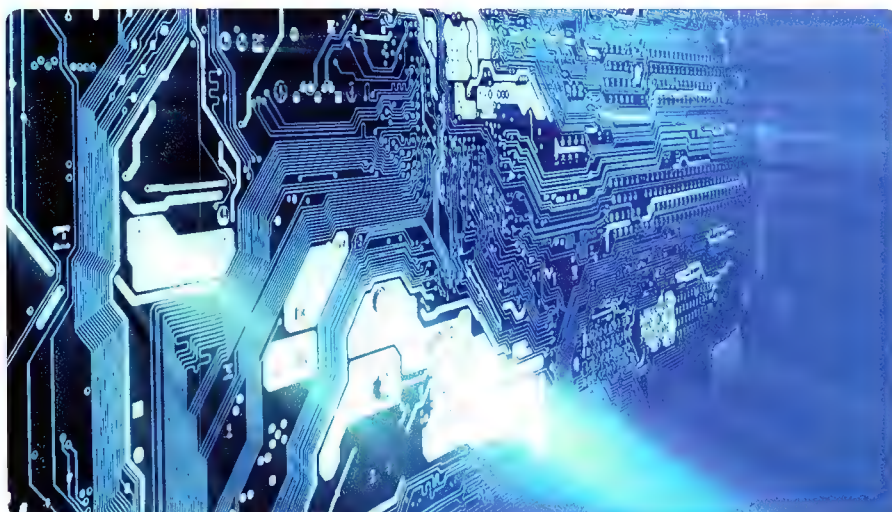
consistent with the rest of the world. This is even more important for your ESXi host as it normally becomes the time source for your VMs within. You may choose to time sync to your ADSL modem or your ISP's server. Either way, in the 'Configuration' tab select 'Time Configuration', then the 'Properties' hyperlink. Set the time roughly in this dialog box, then click the 'Options' button to change your 'NTP settings' (see Figure 9) and restart the service for your changes to

around the vSphere Client and familiarise yourself with the ESXi environment. Next month we will put ESXi to use and create a virtual NAS that can safely store all your precious data in a RAID, act as your backup server and stream your media files. All for free!

However for now relax in the knowledge that you will soon be able to keep The Beast in top pwning shape AND see the Rainbow one-horned horses! Better get some sleep...

VMware Tools is your friend!

Note, when installing a virtual Windows machine you should remember the last task to perform on the VM is to right click on the VM name in the vSphere list and choose 'Install VMware Tools'. This provides an optimised set of drivers for the virtual hardware and allows communication back to ESXi. It also handles time synchronisation back to the host. An essential tool for Windows clients!



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GAMEPLAY

GAMES, GAMING AND GEEKERY COVERED... ATOMIC-STYLE

This being our December issue makes it really hard to pretend that Christmas is not just around the corner – it also leaves us looking around in a state of shock wondering where the hell 2010 went – and that means we're being assaulted by new release games at every turn.

Honestly, we can't move at the moment for fear of being smacked by another delivery of games for review. It's getting kind of scary, to be honest.

But quantity rarely equals quality – and this is why we're here: to sort the gaming wheat from the chaff; find the glittery, shiny needles of awesome in the haystacks of mediocrity; and ... some other wheat-sorting-related analogies, which we would have more time to think up if only these games would figure out how to review themselves!

In the meantime: reviews! Lots of them!

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A thoroughly run of the mill game with some truly disappointing lowlights.

Sometimes a merely adequate game gets released, but you're still able to draw some fun from it. Maybe it delivers just enough cool stuff to see you through the bad, maybe it's got a reasonably addictive risk/reward curve going on. At other times, though, that same merely-adequate game will come out in the company of the true gaming elite, and look like a tonne of steaming shit by comparison.

Sadly, Arcania: Gothic 4 has truly drawn the short straw this month. It's got to try and stand up to the likes of other, better games, but it's also been released in the company of a truly stellar piece of storytelling and RPG mechanics – Fallout: New Vegas.

It's a challenge that poor little Arcania is just not up for.

Wait, where's my RPG?

One of the great joys of any competent roleplaying game is creating and defining your character. When someone gets it right, like Bioware or Bethesda, or any of the top-rating MMO studios, character creation becomes an integral part of the pleasure of the game. Watching that newly-forged character grow and then emerge as a hero (or scoundrel) is the main joy in playing this type of game – listen to many gamers talk about their iteration of Commander Shepard, or the way they've built their Wasteland Wanderer, and you'll see what we mean.

And that makes us truly scratch our heads when it comes to the opening codas of Arcania. You see, the game begins with the usual CGI guff about a world in crisis, a new King fighting

to reclaim his lands and so on... then you get to play that King in what may or may not be a dream, or an attack on his oddly cavernous throne room by skeletons – it's kind of hard to tell. As an intro, it's not bad, and harks back to the opening Vader level of The Force Unleashed – it introduces the game's mechanics and gives you a taste of the larger plot with a larger-than-life character. Once that sequence is over, it's straight to the game's main character: you.

Except, as we quickly found out, you're bit of a dweeb, and you've got very little say in your level of dweebness. There is zero actual

character creation, and you only get to start shaping your character as you level up and start spending skill points.

You start out as a shepherd, you see, and the first few quests are all about proving to the father of your girlfriend that you're a worthy candidate to be her husband and his future son-in-law. You gather a knife from a hidden crypt mysteriously close to the village, scare off a smuggler, and kill a few deer. You do get the odd-sidequest, but to be honest it's all fiendishly linear and highly boring. Curiously, your village is surrounded by locked gates that consume keys hungrily when





you open them, only making the sense of a closed world even more acute.

Now we get that every game needs a highly forgiving starting area where you can learn the ropes, especially in RPGs. But Arcania's starting area makes a couple of glaring mistakes.

First, you quickly get really tired of the half-arsed voice-work in the game. It's full of lame British accents and even worse line-readings, and don't get us started on the execrable screeching pain that comes from the witch who hassles you to kill beetles in her vast underground lair... *"shudder"*.

Her voice, literally, is like having red hot needles poked in your ears while listening to half-witted cats try to procreate.

Even more infuriating is the growing realisation that you – or, more accurately, your character – is a whining git who's managed to get his girlfriend pregnant... and even she isn't particularly likeable!

Sure, the game's going to take you on some kind of epic story arc, but we have to care

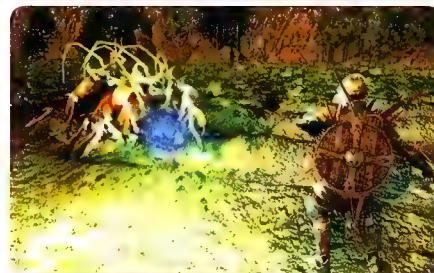
enough to keep playing – and Arcania really makes that tough.

Bring me six deer antlers...

Screeching witches and unwanted pregnancies aside, the game's certainly competent enough. The combat is more action than RPG inspired; every swing is capable of hitting any target in range, and the game's physics engine delivers some very inspiring kills as bodies are flung away from you. Inventory management is kept pretty simple: there's the option to craft many useful items by discovering the right blue-prints, and a simple skill system to help you advance your character in his chosen fields.

But none of it really stands out – there's a distinct lack of flavour, and certainly little in the way of real stand-out mechanics or game systems.

Similarly the game engine can best be described as workmanlike. Sure, there are neat



options that allow you to change the colour palette to match what kind of mood you want, but outside of that, you can't even fiddle with anti-aliasing, let alone anisotropic filtering. That's a particular shame given how much plant detail there is in Arcania's world – what should be a lush and very immersive environment simply comes out looking like jaggy-world on the jaggiest day of the year.

In the year of the jag!

Arcania would likely be a good game if it were released a four or five years ago, but looked at in the spring of 2010, it seems oddly dated and narrow in focus. It's an RPG where you have no impact on your character, and it's a character that's not particularly likable. We get that the rise to power is even more epic the humbler the beginnings, but this is taking things too far – sure, Luke Skywalker used to hunt womp rats, but we didn't have to watch him do it!

And we sure don't want to have to watch too much more of Whiny McShepherd and his annoying girlfriend. **DH** (E)



PC, PS3 an Xbox 360 (reviewed on PC)

Developer: Spellbound Entertainment
Publisher: DreamCatcher Interactive
Website: www.arcania-game.com

Gameplay
Competent, though repetitive and flavourless.

70

Graphics
Please let us use the PC's power more effectively?

72

Sound
OH.GOD.MY.EARS!!!

49

Overall
It's not all bad, but we'd like a bit more good, too...

64%



Front Mission Evolved

This latest mecha-mashing game simply lacks inspiration. And fun. And...

We try to finish as many games as we can when we review here at Atomic. Sadly, it's not always possible. Some games are too long, some games are just... too bad. Then there's a special class of game that thankfully we rarely come across – the game that spits in the eyes of physics and science.

That pretty much sums up *Front Mission Evolved*. It's guilty of many sins, but there's one paramount error that really gets our goat.

Falling... up?

Early on, during the game's opening levels, badguys – we're still not clear who they are, but we're figuring that's not all that important – attack the base of a space elevator. In the lead up to this, you get a wonderful intro cinematic that, for all the game's giant mecha-trappings, promises some pretty gritty sci-fi. That premise is then powerfully shat upon in a series of reveals that out-lame even the lamest of lame plots.

First up, there's the classic young folk owning their own mecha/research/weapons development facility. Seriously, what happens to arms regulation in the future, huh? What's more, the testing ground for this baby-faced arms factory is right on the Hudson River – and protected by naught more than chicken wire. Apparently, misfires just don't happen.

Obviously, the good people of New York are

now fine with high-powered mecha-ordnance being tested in their backyard.

However, young adults and mecha go hand in hand according to popular anime opinion, and with its skating mechs and over the top attitude, *Front Mission* is very anime. That's not the problem, though... no, the thing that really got us, that made us stupidly cranky, was the result of the attack on the space elevator.

You see, space elevators are cool, and as giant sci-fi nerds, we're kind of down with how they work. In fact, elevator attacks are kind of a staple of fiction, and if you've ever read Kim Stanley Robinson's *Red Mars* series, you'll know how epic a collapsing space elevator can be. But in *Front Mission Evolved*, the attack's on the elevator's base. So think about the physics, here. Tonnage that's near continental in scale all hanging from a counter-weight asteroid in space; in fact it's just like swinging a tennis ball on a string.

So when you sever it at the base, it should float up out of the atmosphere into orbit – NOT FALL DOWN CATASTROPHICALLY!!! It's physics people! Sure, we may be reading too much into a game all about giant mechs skating around the city blowing up other giant skating mechs, but space elevator physics are sacred, man.

Anyhoo... the game

Okay, with that out of our system, let's talk about the game. It's just not that good.

On paper, it really should be a mess of fun – your mech (or Wanzer, in the game's lingo) pilot taking on a world-class conspiracy, upgrading and re-tooling your mech... uh... Wanzer as you progress through the game. Mech parts and armour can all be upgraded, there's weight and power to be handled, and weapon types and gameplay to be taken into account. It's all the

kind of stuff that we adore about the classic *Mechwarrior* games, but in *Front Mission Evolved*, it all feels oddly passionless.

Maybe it's the repetitive combat, which quickly devolves into a series of circle-strafing skating matches to see who can nail a Wanzer (stupid name!) in the chest first. There are some neat mechanics, like needing to aim individual missiles in a salvo, or the way mouse buttons and the Q and E keys equate to your hands and shoulders, but that doesn't change the actual nature of the boring combat. Plus the limited nature of the destructible terrain merely shows off how indestructible the rest of it is.

Ultimately, there are better mecha games out there, so unless you absolutely must know how the *Front Mission* franchise is evolving, you'll want to pass on *Front Mission Evolved*. **DH**

PC, PS3 and Xbox 360 (reviewed on PC)

Developer Double Helix Games
Publisher Ubisoft
Website www.frontmissionevolved.com

Gameplay
Some fun elements, but ultimately too repetitive.

60

Graphics
Decidedly lo res, though smooth and fast at least.

71

Sound
Merely adequate.

74

Overall
We can haz fizziks?!

66%



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Fallout: New Vegas

The glitz of Vegas... the dreariness of the Wasteland... but does it all hang together?

Fallout 3 was one of those rare games that took a beloved franchise and not only rebooted it, but revolutionised it, and indeed the entire action/RPG genre. It took the baton passed on by Mass Effect, and ran with it to its logical conclusion by presenting an open-world shooter overlaid with a rich RPG experience in an incredible story in a rich setting. There was almost nothing wrong with Fallout 3.

So, it's logical then that Obsidian, the dev team behind Fallout: New Vegas, might have a task ahead of them in making a sequel that stands proud of its illustrious forebear. However, while it might have stumbled and fallen delivering sequels to other popular games, most notably Knights of the Old Republic, Obsidian's pretty much delivered a worthy successor, but make no mistake – this is an evolution, not a revolution.

And, to be honest, it's a long way from being perfect.

Ain't that a kick in the head?

Well, more accurately, it's a bullet in the head – that's how your latest trip in the Wastelands of post-Apocalyptic America begins.

It's quite the mystery, actually, and very cleverly staged. You're a courier, whose cargo is a single poker chip, who is then waylaid, the chip stolen, and after a short villain-style soliloquy that suggests you're meddling in things way over your head... bang.

That's when the game proper starts, the trauma to your noggin a perfect justification

for one of your rescuers to question you and perform a couple of tests. It's not quite as immersive as the early life sequence in Fallout 3, but it's quicker and very much in keeping with the story. Once again, it also delivers a very viable set of skills and perks, and again, if you dislike them, you can always tweak them to your own satisfaction.

As we reported in issue 117, we got to play the first hour of New Vegas at Gamescom, so we were looking forward to discovering what we could do differently – and we weren't surprised. Your first real encounter involves a local gang

member trying to extort a bar owner – figuring that a bullet to the head can leave a guy a little short-tempered, we dealt with the dude rather harshly. Once he admitted he was thinking of taking over the town... we shot him. Such a move pretty much let us skip over the entire opening portion of the game, a good example of just how open New Vegas' storytelling is.

Also, like the original, it's a game that's very easy to adapt to your own playing style, and a game that very quickly starts telling a uniquely tailored story. One thing that Fallout 3 did well was when two or more players of the game got





together to compare notes – a casual listener could be forgiven for thinking that each gamer was talking about a different game. The same high praise can be given to New Vegas.

Crafty critters

As well as the story, Obsidian's also brought a lot of new game mechanics to the Wasteland. Crafting, for one thing, has been vastly expanded and changed. You no longer need blueprints, and can now make food from scavenged plants and animals. You can also craft neat new ammo types for all your weapons. As usual, weapons need a workbench, but food requires a campfire, and ammunition a loading bench. Thankfully, you never feel punished for not wanting to get into the crafting game – we're not one of nature's compulsive crafters.

Also new is the faction system. The Mojave Wasteland is full of bandits, gangs and fighting factions, as well as independent towns, and the game now tracks your standing with all of them. The rewards for getting to know a faction are

obvious – discounted stuff, free passage, all that, while the punishment for pissing a group off is similarly obvious.

Getting shot in the face. Lots.

Again, it's not an overpowered part of the game, but it does lend a certain Yojimbo-like feel to New Vegas, that constant hint that if you play your cards right you can play off all the competing factions. Of course, like all good dramas, you must choose a side in the end, but getting there is a heck of a lot of fun if you're willing to be a wily git to everyone you meet.

A wide range of brown

Sadly, the game's not so good that you can easily overlook some of the flaws. For one thing, while the updated engine looks great, the setting can be a little drab. But you're going to get that with almost any game that's actually aiming for a dreary, post-war feel.

What's quite unacceptable is the seemingly random rate of terrain and character draw-in. There are some truly impressive vistas in New



Vegas, but traversing them can often lead to awkward surprises – whole groups of buildings and gangs of marauding ghouls can pop up almost right on top of you. At other times, you can see figures moving across vast distances.

There have been reports all over the net of far worse bugs, but they're about our only big issues with the game. That said, the pop-in thing can be pretty demoralising – if you get the wrong opponents appearing out of nowhere they can be almost impossible to beat, even using VATS.

Overall, *Fallout: New Vegas* is every bit as compelling as *Fallout 3*, even if it does seem a touch staler and buggier by comparison. **DH**



PC, PS3 and Xbox 360 (reviewed on PC)

Developer Obsidian Entertainment
Publisher Bethesda
Website <http://fallout.bethsoft.com/>

Gameplay
Rich, varied and highly open.

98

Graphics
As lush as you can get, but troubled by pop-in.

79

Sound
Good music, average voice work despite a stellar cast.

76

Overall
A worthy successor.

88%



Enslaved: Odyssey to the West

A new take on a classic myth-cycle delivers some great gaming.

The importance of story in video gaming is a debate that never quite seems to lose its edge. It's a remarkably complex one too, with the same people who wax lyrical about, for example, the breadth of Halo's historical backstory often being the same people who eschew the single player campaign and spend their evenings indulging in a joyous round of teabagging.

To lay some cards out on the table before we start, this particular reviewer highly values narrative, even to the point of putting up with deeply flawed gameplay (looking at you Alpha Protocol) or remarkably sub-par graphics (yes, we see you Dragon Age: Origins) for a game that really sizzles in the story stakes.

Enslaved: Odyssey to the West is a particularly clever retelling of the classic Chinese folk tale, Journey to the West. For most of us, this allegory for the path an individual must take on their way to enlightenment is best remembered as the TV show Monkey – a show made in China, by a Japanese production company, dubbed into English by the BBC and regularly broadcast on the ABC in its 5pm slot. Enslaved takes a slightly more authentic look at the original tale and, perhaps a little sadly, avoids any mention of "the funkiest monkey that ever popped".

Set roughly 150 years into our future after a robot apocalypse has decimated mankind and left the survivors existing in tiny isolated pockets, Enslaved places the player in the size 14 boots of Monkey, a hulking simian brute of incredible strength and agility. Tricked (initially)

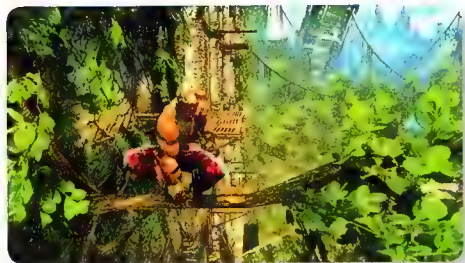
into aiding young techie Trip into finding her way home – thanks to a jury-rigged slave headband on Monkey that will explode if she dies – the pair embark on a long journey from the East Coast of the US to the West.

Enslaved's gameplay is a strange mix of platform, combat, escort quest, item collection and the odd puzzle thrown in. Core to the game is the platforming element, with Monkey's insane agility letting you leap from handhold to handhold in exploratory moves that feel like Ezio at his very best. Ninja Theory has made this an extremely fluid experience and even though there's not a huge amount of skill required (with notable exceptions) it's highly rewarding.



Sadly, the combat is a little less polished, with Monkey having the standard mix of heavy and light attacks via his staff, plus an energy shield for blocking opponents. It gets a little more interesting when the staff gets a ranged attack





upgrade but, except for the occasional finishing move, you'll mostly find yourself whaling on robots until they explode in fiery chunks. With the ranged attacks, Monkey can fire either stun blasts to disrupt shields and freeze enemies, or plasma bolts to cause actual damage – swapping back and forth between these will become second nature as you rapidly blast away mech shielding before destroying them with a quick plasma blast. Gather enough of the 'tech orbs' conveniently floating around and you'll be able to upgrade health, combat abilities and more, thanks to Trip's electronic wizardry.

While Trip isn't exactly defenceless – she has an EMP blast she can use to freeze attackers – she's certainly not a brawler like Monkey. You'll spend a lot of time protecting her or distracting robots while she runs to a safe area. That said, Trip can return the favour, using an electronic baffler to keep the mechs' attention elsewhere while Monkey sneaks around for some devastating attacks. Trip will also be essential in later puzzles when you need two people to operate a series of switches. These are never overly difficult, but do add a nice element to the climb-kill-climb sections.

One thing that truly stands out in Enslaved is the depth of characterisation. Mo-capped in entirety by Andy Serkis – face, body and voice – Monkey has an incredible sense of athleticism and emotion, both in-game and during cut-scenes. Trip adheres to Ninja Theory's love of lissom redheads, but the devs have done a superb job with her facial expressions and voice work. Piggy, when you meet him later in the game, is similarly excellent. In fact, without the characters and their nuanced interactions, Enslaved would be a vastly different (and lesser) game. The script by Alex Garland (The Beach, 28 Days Later) wouldn't work half as well as it does without the

commitment from the three players – it's something that other developers should be playing a lot of attention to.

Design-wise, the Enslaved works on breaking that post-apocalyptic mold. Forget the bleak, beige and battered landscapes of Metro 2033 or Fallout 3 – Enslaved is a lush green, with plant life taking back the Earth in humanity's absence. Crumbling buildings around New York are covered in vines and grass, bright sun blazes down and the whole environment feels oddly cheery – if you can ignore the giant robot dogs attempting to eat you.

While Enslaved is not without its flaws – camera angles can be frustrating, combat difficulty can skew oddly when bosses arrive and your finishing move animations can become so repetitive that you'll want to lose just for some variety. But ultimately this is a very different game to what we've become used to. The term cinematic is well and truly over-used and misused in gaming, but Ninja Theory have brought cinematic production values to Enslaved to create a title that succeeds as both a game and a genuinely enthralling story – certainly, no mean accomplishment. **ENH**

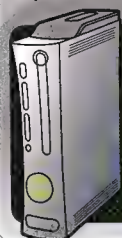
PS3, Xbox 360 (reviewed on 360)

Developer Ninja Theory
Publisher Namco Bandai
Website www.enslaved-thegame.com/

Gameplay
A solid mix, with some repetitive sections. **85**

Graphics
Intense colours and superb animations. **91**

Sound
Impeccable voice and incidental music. **91**



Overall
And enthralling game with a unique storytelling perspective.

89%

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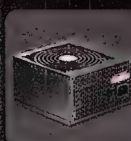
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The reboot of the classic military franchise is finally here... and it's a seriously mixed bag.

We're a sucker for a good war movie. Black Hawk Down, A Bridge Too Far, even the classic Wild Geese – all show fighting men dealing with the extremities of war to thrilling and dramatic effect, without ever really cheapening their sacrifice. That's pretty much been what Medal of Honor – the original military franchise – is all about: honouring the men and women who fight and die for us, while also delivering a game that's as entertaining as it is impactful.

That's pretty much what Electronic Arts has been promising with the reboot to the series, controversially set in the ongoing Afghanistan conflict. To that end, EA's been very vocal about its recruitment of serving spec ops types – or Tier One Operatives, as EA reminded us in trailer after earnest trailer. Even when we visited EA's LA HQ last year Greg Goodrich, lead producer on the project, was keen to point out the intense level of verisimilitude they were hoping to achieve with the game.

Which, taken altogether, makes the resulting product all the more baffling.

One product, two games

Delivering two executable files to separate singleplayer from multiplayer is nothing new – Call of Duty did that with CoD4 – but the way Medal of Honor delivers the two experiences is curious to say the least.

The singleplayer game uses the frankly aging Unreal 3 engine, and on PC it's supremely unsatisfying to fire up a game you have high hopes for and be greeted with barely adequate

graphical options like Antialiasing: Off or On. And it looks like it's only 2x AA at that!

The multiplayer game uses the Frostbite 2.0 engine from Bad Company 2, and it's an altogether more appropriate beast for PC. In fact, it's one of the best looking online shooters we've played this year.

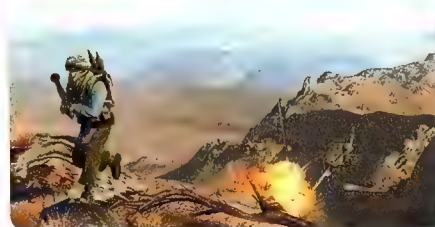
It's a worrying trend from EA games, and one that matches the aforementioned Bad Company 2 – a lacklustre campaign experience but a more or less solid online one. Which is a shame, because it really wouldn't take a lot to lift Medal of Honor's singleplayer experience from adequate to awesome.

The story starts strong, placing the player as a member of a small unit of specialists – Tier One Operators of the highest skill level – seeking out



an informant in an Afghan village. But it's a setup, and before long it's a running battle through the streets and buildings of the town. As a set piece, it's very well staged, but it quickly becomes apparent that that pretty much sums up the entire game – set piece after scripted set piece, with very little in the way anything resembling





open or surprising gameplay.

There is a great story here, don't get us wrong. How can there not be when you're trying to depict the actions of arguably some of the most skilled warfighters on the planet? But it seems that story, and the men it's trying to depict, get lost under one gaming cliché after another – the last stand against waves of enemies, the ambush, the sniper level... it's cookie-cutter.

There's some really solid action dialogue, however, and though it may be a bit overcooked for some gamers, it really does suit the subject. The motion capture of the elite characters is similarly top-notch, but for every moment of immersion in the game, there's a bug or omission that drops you right back out again. In the second chapter, it's the pickup chasing after you that's utterly empty – no drivers, no gunner in the back – that's still managing to shoot at you. In many others, it's the realisation of just how linear the game is – and really, what competent military force attacks up a ravine while not even trying to take the high ground?!

Sadly, it's simply not a compelling enough experience, and really doesn't live up to the level that Medal of Honor has offered in the past. It's not the worst game in the franchise, but it's

certainly a long way from what we were hoping for in a reboot.

For you and a friend...

Then, of course, there's the multiplayer portion of the game, which makes the campaign seem like a mere afterthought by comparison.

With the vastly upgraded engine it's a much more immersive experience, and without the occasional annoying AI glitches of the campaign, immensely more satisfying. We had been sceptical about the 24-player limit on matches, but the maps are all so finely tuned that you don't really miss the extra eight bodies. The game modes are a wonderful mixture of slogging matches akin to Bad Company 2's Rush mode (though with only one objective per stage), map domination, and fast paced objective matches.

But it's not all wine and IEDs here, either. For one thing, some of the more interesting stance options from the campaign mode, like lean and prone, are not present in multiplayer. Once upon a time you couldn't make a military shooter without such moves; these days it seems like devs have forgotten how. It's like we're in a Dark Age of game design, banging the code and design ethics of a previous renaissance together in a fit of barbarian confusion.

The class-system is also a bit anaemic. Bad Company 2's classes have very defined roles, but considering there are few vehicles in MoH, the Spec Ops rocket launcher seems a waste; and with the ability to so easily fire sniper rifles from the hip or pull off long range shots with an assault rifle... there doesn't seem to be a lot of differentiation on offer.

But the good far outweighs the bad. Support actions, Medal of Honor's answer to kill streak awards are satisfying without being nearly so powerful, and every weapon feels beautifully tooled and lethal. What's more, with the superior graphics engine combined with great motion capture, the multiplayer game is easily the more immersive of the game's two parts.

Which, when you get down to it, makes this one of the hardest games of the year to actually rate. But since it is one package, we have to judge at as such – that being the case, Medal of Honor's singleplayer campaign, despite some highpoints, really does drag the title down. If released by itself, we'd be very tempted to give a Hot Award to the game's multiplayer, but taken as a whole, Medal of Honor has proven itself unable to live up to EA's hype. **DH**

PC, PS3 an Xbox 360 (reviewed on PC)

Developer EA, DICE, Danger Close
Publisher Electronic Arts
Website www.medalofhonor.com

Gameplay
Great multiplayer, but disappointing by yourself. Like sex.

76

Graphics
Again, a mixed bag.

72

Sound
Competent voice acting, but stellar work on the weapons of the game.

80

Overall

A disappointing reboot with some shining moments.

75%





Final Fantasy XIV

Quite possibly the most impenetrable game you'll play this year...

There's a school of thought that says MMOs, especially as typified by the World of Warcraft model, are too easy. That they're by and large tailored for the lowest common denominator, lack complexity, and don't deliver nearly enough challenge or gameplay complexity.

These are the kinds of gamers who no doubt look at a game like Final Fantasy XIV and think "Eureka! A game with a proper learning curve! And complexity!" But even the most ardent WoW-hater, the most vocal of those looking for a challenge instead of a grind, would weep at the utter inane complexity of FFXIV.

And that's before you even get into the fucking game.

Epic account fail

To say that FFXIV is an impenetrable mess is an insult to other impenetrable messes, and the lack of transparency begins before you even get playing. FFXI had a similarly problematic account and payment system, but the masterminds behind XIV seem to be even more actively making sure people never play their game.

For instance, not only do you need to sign up for an account, you then need to create a sub-account for your payment options, and then sign up for an external service that takes care of credit card deductions. That's three accounts, for one game! What's worse, even using the manual as a guide – surely a bad sign – it's still a confusing and often bewildering process. For instance, what do you think this phrase means:

"To create characters on your FINAL FANTASY XIV service account, you must possess automatically continuous options."

It's typical of the entire painful process. Sadly, we were able to work it all out eventually. In many ways, we should have just learnt our lesson from the account process.

Epic gaming fail

After a more or less baffling but suitably epic cinematic intro, the game gets down to character creation. It's pretty deep as far as such things go, sitting somewhere in between the hyper-basic options of WoW, and the hyper-detailed options in Age of Conan (does anyone still play that?). However, it too also gets quickly annoying; once you choose your voice type, for instance, your fledgling toon starts to sign off from every finalised option with a laugh that can be best described as... scary. Not to mention annoying.

In fact, by the time we were finished creating our faux-elf (you can call them Elezen, but if they're tall and pointy-eared, they're an elf) blacksmith we kinda hated the chuckling jerk.

But that does touch on one of the few things we were impressed with in FFXIV – the class system. From the get-go, not only can you sign up for any of classic melee, ranged or spell-using classes, but you can also take a crafting class. Even more impressive, class is a mutable thing, depending more on how you're equipped than any mere job description.

That, however, was about the last and only thing we were impressed by.

After another cinematic, and a brief fight – where your best attack is throwing stones! – you find yourself in whatever starting city you've chosen. If you're a habitual MMO player, you know what to look for: a quest giver or something similar, something to give your game experience a bit of direction; except, in FFXIV, direction seems to be something that didn't actually make it into the final build.

Instead you're left with the lingering feeling that you're missing something obvious, that if you look a little harder things will start making sense. But that realisation never occurs. Instead

you stumble about looking for quests or at least things to do to pass the time, while trying to work out who are the players and who're NPCs. When you do get a reason to leave the city, the open environs are large and pretty, but largely empty. Sure, the boar-heavy stock of most MMOs is probably over the top, but where's the fun in wandering through an empty landscape, to find a quest hub that is lacking in quests?

As to the combat, it's a poorly timed exercise that seems to have no relation to what you're seeing on the screen, making the timing of the abilities problematic at best.

We'd been looking forward to something a bit meatier than your average MMO. Final Fantasy XIV, however, is a huge mouthful of poor game mechanics, unfriendly UIs, and aimless storytelling – one that's more likely to choke any optimism right out of you. **DH**

PC (PS3 version coming May 2011)

Developer: Square Enix PDD 3
Publisher: Square Enix
Website: www.finalfantasyxiv.com

Gameplay

Painful, impenetrable, and plain un-fun.

39

Graphics

Suitably lush, but a little sparse.

80

Sound

Still can't get that spooky laugh out of my head.

69

Overall:
Definitely a fantasy too far.

48%





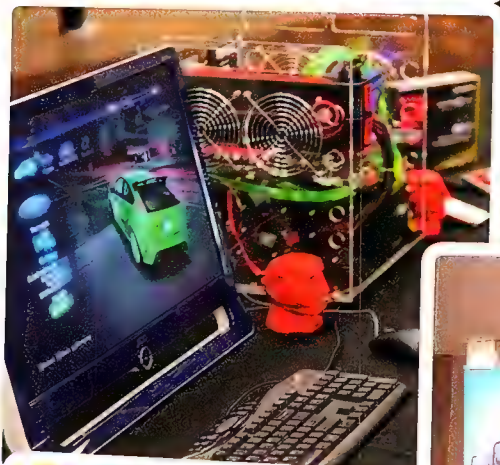
Atomic Unlocked!

Catch all the action of the recent Atomic Unlocked event in Sydney & Melbourne – the Atomic Beast, cool Avermedia products, and great gaming from Intel & Team Immunity.

If you attended our recent pair of Atomic Unlocked events, you'll know it was a hoot. If you missed out, here's your chance to get a taste of the awesome on show in Sydney and Melbourne!

Both shows were a great success. In Sydney, Graham Tucker from Intel kept us all informed on the company's CPU roadmap into 2011, the new Sandy Bridge architecture, Light Peak technology, and his own love of HTPC computing. At the Melbourne leg, Thomas Tapsas took over. He was great, talking all about Intel's future plans and even dropping

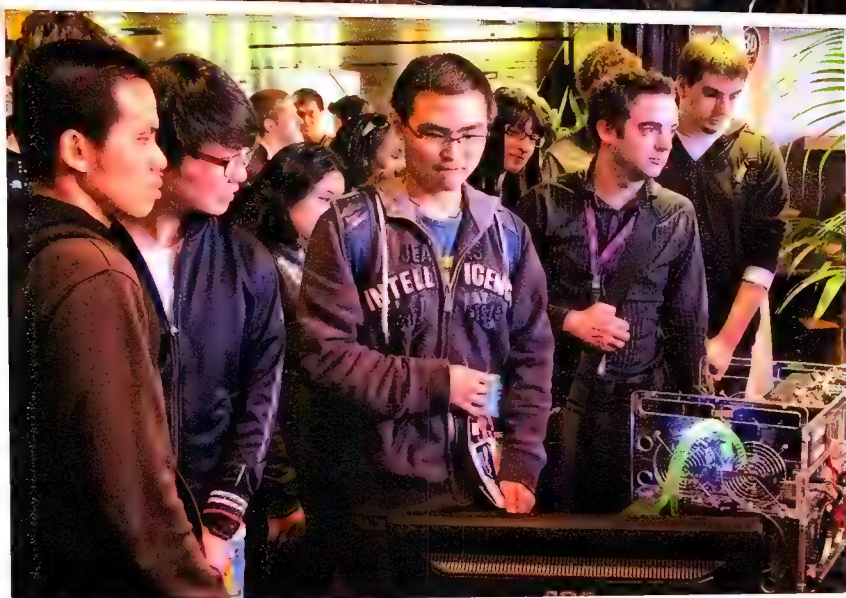




a few hints about some as yet unannounced CPU products that had us drooling!

Kevin Hartin from Altech, who any veteran of the last two Atomic LIVE days should easily remember, took care of introducing us to the new Avermedia Aver3D CaptureHD. It was a great discussion, covering everything from why 3D matters to PC users, to the kind of system you'd need to take full advantage of such a card – ie, nothing too beefy, as the card offloads most of the hard work.

Finally, we spoke with Team Immunity's Tony Trubridge about the state of pro-gaming and just exactly what it takes to make the leap to the pro-circuit.

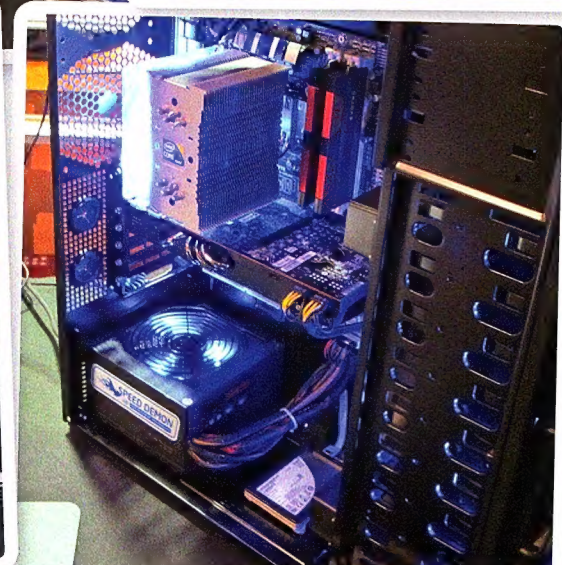




At each event the floor was open all the way through the show. We really love being able to host events like this – they're not only fun, but we get to show off to our partners just how clued in you guys are.

After each show we got down to the hanging out part – not to mention the drinking part! Readers got to chat to our guests, check out awesome hardware from Kingston, Intel and Avermedia, and even take on one of Team Immunity's best to claim a hot K-series chip from Intel. And man... those guys are good.

So thanks to everyone who came along, and to our partners and guests. And soon, hopefully we can take this show to Brisbane... ☺



Where's your game at?

Ben Mansill remembers when game boxes were bigger, better boxes.

I've never met a gamer who didn't like showing off their gear. We're proud of our toys, and take great care to create personal environments that fuse man-machine, and just as importantly, show off how much shit we've got.

It's been rumoured that a new thread is started in Atomic's Green Room every hour asking for desk photos to be posted. The OP pic is usually somewhat bland, and with the usual "I just took a quick shot now, I know it's a bit of a mess" out of the way, but what's clear is the great pride the owner has of their space. Those threads pick up, too, with subsequent shots showing ranging levels of tastes, equipment and neatness. An almost, but not quite, out of shot bong, a tissue box and one to several dozen 2L Coke bottles often adorn the scene.

There beside the desk, across it, under it or over it, are the stacks of game DVDs. Quietly well behaved, in an efficient orderly rank, these entertainment bricks are just about bang-on the best way to fill a geek's shelf. They cohabitate with their friends the movie DVDs and Blu-ray beautifully, and almost without thought it becomes easy to create really nice shelving



third taller than they need to be! The 8-16 page manual squishes into nothing, and the data, well, that's only going to be installed anyway...

Which brings us to humankind's next great leap in the field of the efficient and practical storage of one's games. Data is expressed as a series of ones and zeroes (that will be in the test), and every single one and zero in the

of it in those terms. The problems that led to the evolution of storage we enjoy today were well understood, it's just that it wasn't a problem at the time. I'm talking big fat chunky game boxes, cardboard ones stuffed with a stack of discs that rattled around and a manual you could chuck a Boeing 747 with.

It's one thing having a collection of, say a hundred games; it's quite another to give them a proper home. How do you stack the unstackable? Game boxes, the old kind, were humanity's saddest engineering fail.

No two were ever the same size. Proper game boxes were at least five times bigger than they needed to be to hold what was inside. Odd shapes weren't unknown – Comanche was a top-cropped pyramid with one curved side and about 5 different mini-box shapes that made up the whole. It looked fabulous precariously balanced on a flat surface with a 2m exclusion zone from any other object, but would collapse if you looked at it the wrong way.

As collections grew the problem was realised. Do I stack them vertically? They'll crush if you do that! What if you want to play one that's at the bottom of the pile? How about lining them up horizontally? Can't do that, idiot! The foot-long boxes, the weird ones and the little rattlers...do I line them up from tallest to shortest? Do that and people will think the crap game in the big box is your favourite because it starts the row! Should the book-size manuals be taken out and kept on a separate book shelf? What about the codewheels? The codewheels! Should I keep them all in one safe place, or keep them in the crushed and frayed package that's never where I think it was.

No home deserves that kind of negative Zen. It all amounts to a feng shui shitstorm, peaking in the late 90s and imploding like the house at the end of Poltergeist. Swept aside by tidy little standardised ruggedized fun units, the proper game box remains, I hope, something you have a few of and won't ever, ever chuck out.

Take my Steam Games list, as a supremely elegant example. There they all are! Look at 'em! So many lovely games, all mine.

arrangements. A souvenir tourist ornament tucked in here, the last sports trophy you'll ever win sitting on top of a few CDs, mixed up with some books, and suddenly you've got a home storage and decoration solution that wouldn't unbalance even the analist domestic geek.

But let's face it, it's far from ideal. There's a lot of wasted space in those boxes. They're a

damn house ought to be on one of the multi-terabyte hard drives arrayed throughout the modern home. Take my Steam Games list, as a supremely elegant example. There they all are! Look at 'em! So many lovely games, all mine. What could be more efficient than a little window listing them all and once it's closed, they're still there but they're gone! If this isn't magic Puff the Magic Dragon can blow my balloon up.

Over on the shelf, game boxes still arrive, but the drop off has been cataclysmic. Peak Game Box Influx was passed at least a year ago, as Steam and the other lesser-Steamers proved that evolution is real by becoming the preferred choice for sensible gamers. The only reason to get a game-in-a box now is if no digital distribution store sells it, and of course, every single store sells every single thing, so it's bye-bye boxes. In another year or two the dusty boxes on the shelf will begin to contract like a very old sun, and will eventually consume themselves like the Easter Islanders did. No more coconuts for you!

Like approximately most of everything about computers, no-one saw change coming. A game box was once an unquestioned certainty, so much so that nobody ever thought to think



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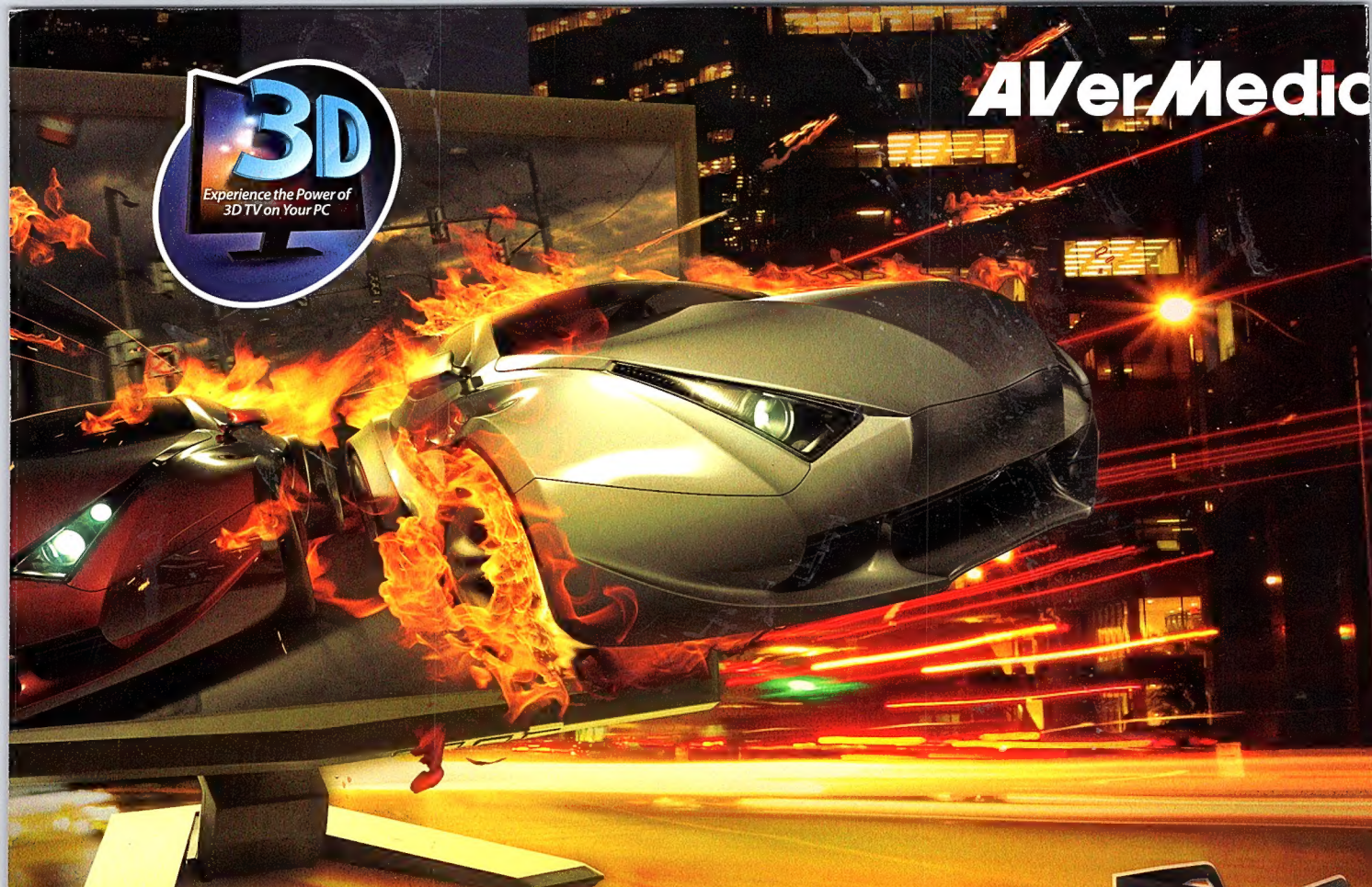
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